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MOEE HYDROGEOLOGICAL TECHNICAL INFORMATION REQUIREMENTS FOR LAND DEVELOPMENT APPLICATIONS

April 1995

Ontario
Ministry of Environment and Energy

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April, 1995

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The Steering Committee and the Office of the Provincial Facilitator provided valuable input and review comments on this document. A special recognition is given to Mr. Robert Ryan for assistance in the interpretation of MOEE technical guidelines, relating to individual water supply and sewage systems.

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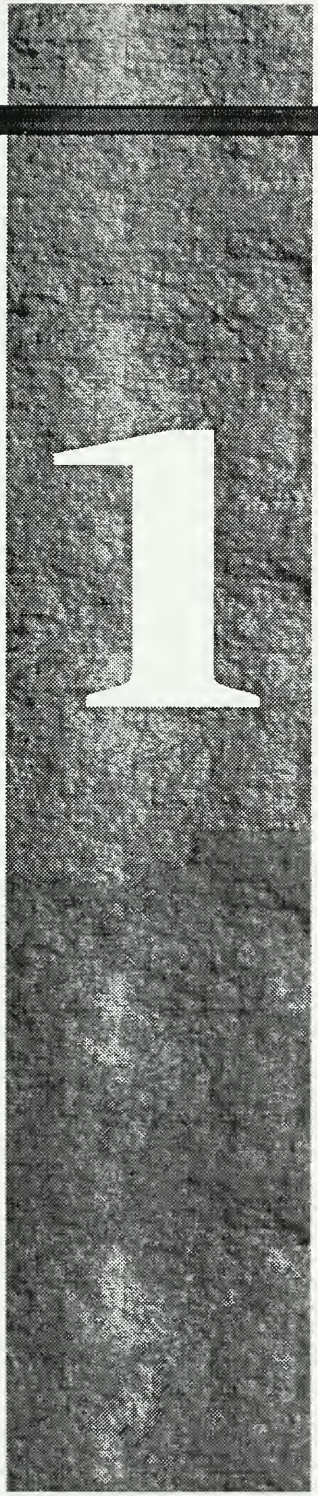


1 INTRODUCTION

CHAPTER 1

INTRODUCTION

1.1 PURPOSE

This document is intended as a guide to the information requirements of existing Ministry of the Environment and Energy (MOEE) policies and guidelines for hydrogeological studies in support of development applications. There applications are typically plans of subdivision, condominiums, official plan amendments, and any other forms of development plans which would be based on individual wells for water supply and/or on individual subsurface sewage disposal. The ground water and surface water interests of other agencies are also recognized.

This document was commissioned by the Ministry of Municipal Affairs (MMA) through the Office of the Provincial Facilitator as part of a corporate effort to improve the planning and development applications approvals process. The purpose of this effort is to improve the fit between technical studies prepared by consultants and municipalities in response to provincial policy interests, and the expectations of provincial review staff. This is intended to reduce the amount of time and frustration experienced in meeting provincial requirements. This is one of a series of studies commissioned to deal with commonly required technical studies in support of development applications.

This document includes:

a) Guidance to proponents of land development in determining when hydrogeological studies are required;

b) Identification of issues related to hydrogeological studies which may need to be addressed as part of or in conjunction with a hydrogeological study;

c) MOEE hydrogeological information and documentation requirements from existing policies and guidelines; and

d) Generic examples of hydrogeologic environments representative of conditions encountered in Ontario and conceptualized hydrogeological study components for these environments.

This document is intended to provide a common basis of understanding for proponents of land development and their consultants as well as MOEE review staff. This is intended to assist proponents of land development in meeting the MOEE technical requirements and provide consistency in MOEE review of hydrogeological reports.

The information contained in this document is, for the most part, generic in nature and is not intended to provide detailed methodologies for site specific studies. These will need to be developed on a case by case basis for individual development applications by the proponents and/or their consultants.

It should be recognized that MOEE guidelines and policies have changed significantly over the past few years and are likely to undergo changes in the future. It is therefore essential that proponents of development applications and/or their consultants work in consultation with MOEE staff to ensure their current requirements are being met.

1.2 WHO SHOULD USE THIS DOCUMENT?

Sections 2 and 3 of this document provide basic information regarding the land development application process and hydrogeological issues associated with land development applications. This is directed at proponents of development applications as well as staff of other agencies such as municipalities, Health Units, Conservation Authorities and others who have an interest in or are involved in ground water issues.

The information presented in Sections 4 and 5 of this document is primarily of a technical nature and is directed at practitioners in the field of hydrogeology. It is assumed that the primary users of the document will have some formal academic training in hydrogeology as well as job-related experience pertaining to hydrogeological studies in support of land development applications.

This document is not intended to provide basic training for hydrogeologists. The material presented, although technical in nature, is described in as non-technical a manner as possible so as to be of value to non-hydrogeologists in understanding the essential technical requirements and basic approaches to undertaking hydrogeologic studies in support of development proposals. Selected terms are defined in a glossary, Appendix D, to assist in the understanding of this document.

1.3 STRUCTURE OF THIS DOCUMENT

This document is intended to be used as a generic guide or 'road map' for proponents of development applications and/or their consultants to lead them through the process of completing hydrogeologic studies in support of their development proposals. This document starts with the description of the development application process. Section 2.0 provides guidance on how to get started through the development application process and more importantly who or which agency(ies) should be contacted for specific guidance.

Hydrogeological studies are only one component of many that may need to be addressed as part of a development application. The relationship of hydrogeological studies to other environmental and planning issues is discussed in Section 3.0. Knowing the larger context in which a particular development occurs is also important as this will determine to some extent the nature and scope of hydrogeological investigations required. Section 3.0 provides guidance in identifying the issues that relate to hydrogeological studies for development applications. It also provides a discussion of how far beyond the limits of a property a hydrogeological study should extend.

Section 4.0 includes the technical information requirements of the MOEE based on existing guidelines and policies.

These requirements are conceptually illustrated using examples of representative hydrogeological settings typically encountered in Ontario in Section 5.0. Major components of hydrogeological studies identified in MOEE guidelines are discussed. General conclusions are presented in Section 6.0.

2

LAND DEVELOPMENT APPLICATIONS

CHAPTER 2

LAND DEVELOPMENT APPLICATIONS

2.1 HOW TO GET STARTED

The proponent of a development proposal should start by referring to '*Guide to Provincial Planning Applications, September 1993*' by Ministry of Municipal Affairs (MMA). The document is an excellent reference guide to the planning and approval process. It defines what is needed to prepare complete applications for development proposals and includes:

a) steps that should be taken before an application is submitted;
b) how to prepare an application; and
c) how to manage the application once it has been submitted.

The emphasis in the guide is on approvals normally granted by the Province including:

a) Official Plan Amendments;
b) Subdivision plans;
c) Condominium plans;
d) Consents; and
e) Zoning order amendments.

The guide also provides a summary of Provincial Issues and Required Studies including hydrogeological studies.

The intent of this Technical Information Requirements document is to provide detailed information regarding required hydrogeological studies in terms of their technical content and approach as they relate to specific hydrogeological issues within the context of the Ministry of

Municipal Affairs guide to Provincial Planning Applications. The reader is referred to the '*Guide to Provincial Planning Applications*' for an explanation of the types of planning approvals and applications which may be required for development proposals.

2.1.1 How Will The Development Be Serviced?

The proposed or preferred method of servicing the development will need to be established early in the process. The MOEE '*Policy on Planning for Sewage and Water Services*' and Implementation Guideline for Policy Statement B7, '*Planning for Sewage and Water Services*'. These documents support the Comprehensive Set of Policy Statements under Section 3 of the Planning Act, 1995. Municipalities or their equivalents are expected to investigate servicing options by means of a **'servicing options statement'** in the absence of municipal wide sewage and water servicing plans that have been adopted in approved official plans. Included in Policy Statement B7 is a hierarchy of servicing preferences in the following order:

a) municipal services;
b) communal services; and
c) individual on-site private services.

MOEE technical guidelines for hydrogeological assessments for development based on private servicing require municipal justification for the use of individual on-site sewage systems and individual private wells as a prerequisite to considering support for development applications. It will therefore be necessary to provide some justification for the type of servicing proposed. This will likely involve municipal planning issues. The local or regional municipal official plans may provide guidance with regard to the preferred method of servicing for a particular area. It may be sufficient, in cases where servicing plans exist, to reference these plans as justification for a particular type of servicing. Where no servicing plans exist, it must be demonstrated by the municipality that servicing options have been investigated. This should be documented in a **'servicing options statement'** which must be prepared and/or endorsed by the municipality. The servicing decision, made by the municipality, would then be submitted as part of the planning application by the proponent.

The **servicing options statement** should address:

a) an evaluation of proximity of existing or committed full municipal services or communal services and the ultimate potential for future connection to full municipal services or communal services for the whole area proposed for development;

b) where a development application is known or anticipated as being one of a number of proposals for the same development area, the evaluation of servicing options should not be isolated to the site-specific proposal. It should be completed within the context of the development potential for the whole area as determined through consultation with the municipality and based on proposed or established long-term municipal servicing plans and growth management objectives;

c) an overview of the environmental suitability of the site for the proposed services based on information accessible at a municipal scale that can be applied to the proposed site and generally addresses:

   i) environmental constraints (e.g., environmental features, surface water, ground water);
   ii) suitability of the terrain (e.g., soils, topography) of the site;
   iii) the performance of services in similar developments in the surrounding area; and
   iv) the scale (total areal extent), density, and type of use proposed for the development;

d) an evaluation of the relative potential and merit of each of the servicing options to serve the proposed development; and

e) documentation of the decision-making process and rationale that led to the determination of the servicing option proposed for the

development.

If the preferred servicing option is individual private services, then detailed hydrogeological studies is to be completed in accordance with the MOEE technical guidelines in support of the development proposal.

2.1.2 Is The Proposed Development Feasible?

The proponent of a development proposal may have very specific requirements to make the proposal viable or economically feasible. The key elements of the development should be identified at the very beginning of the process. For example, the economic viability of a particular development may depend upon securing a minimum number of lots for residential development or upon a certain type of development such as a golf course.

Once the essential requirements of a development proposal are identified, the proponent may wish to undertake initial investigations to determine the feasibility of the proposed development before proceeding with more detailed and complete studies to meet the hydrogeological requirements of the MOEE and other agencies. For example, it may be possible to determine at a fairly early stage and with relatively little effort whether the property can sustain a certain density of development on individual on-site sewage systems or whether there are likely to be adequate supplies of ground water for a golf course. This may be determined largely on the basis of existing information such as well records, maps and any available, relevant groundwater reports for the immediate area. It would be unwise to proceed through a potentially costly process of detailed studies and planning reviews only to find out at the end of the process that the property could not sustain the level or type of development required. Preliminary hydrogeological assessments can be useful in determining whether the development application should proceed to the level of study required to meet the MOEE technical information requirements. **Preliminary feasibility studies may form the basis of more detailed hydrogeological investigations; however, they will not be considered adequate or complete by the MOEE as a basis for recommending approval of the development applications.** The primary benefit in completing such studies is in providing a preliminary indication of whether the proposed development is feasible on the subject property and whether other development options should be considered. The Regional office of the MOEE and/or a qualified and experienced hydrogeological consultant can provide guidance for preliminary feasibility studies.

2.1.3 Role Of The Ministry of The Environment and Energy

The MOEE has the legislative responsibility for the management and protection of ground water and surface water resources in the Province of Ontario. This authority is provided under the Ontario Water Resources Act R.S.O. 1990, the Environmental Protection Act R.S.O. 1990 and the Environmental Assessment Act R.S.O. 1990. Large water takings (i.e., greater than 50, 000 litres per day) are regulated by the MOEE through the Permit To Take Water program. Activities which may result in adverse impacts upon ground water quantity and/or quality are controlled through MOEE environmental approval procedures which in some cases will involve the issuance of a Certificate Of Approval. The latter is required for such things as communal or municipal sewage and water systems and regulated waste discharges to ground water or surface water. Development applications are reviewed by MOEE staff as part of the land development planning process to:

a) protect the quality of ground water for the greatest number of beneficial uses; and

b) ensure the fair sharing and conservation of ground water.

2.1.4 Role of Other Agencies

The main agencies that are likely to have an interest in the completion and review of hydrogeological studies include the following:

Ministry of Municipal Affairs (MMA), under the Planning Act, has the responsibility for the approval of official plans, official plan amendments, subdivisions, consents, and zoning order amendments. MMA also has the ability to delegate and has delegated approval authority for OPAs to some regional municipalities and subdivisions to many municipalities. In southern Ontario consent approval is automatically assigned to local municipalities or to Committees of Adjustment. In northern Ontario, MMA has delegated consent authority to several Planning Boards, but retains this responsibility where there is no Planning Board, or the Planning Board has no Official Plan. All regional municipalities and cities of the north have subdivision approval authority.

Several separated municipalities and some counties with planning departments have, or will have in the near future, this same authority for subdivisions.

MMA also provides a coordination role for circulation, review and comment by government agencies on various planning and development applications that have not already been assigned or delegated. MMA will require that the concerns of various agencies are or will be adequately dealt with as a condition of approval for the development application.

Ministry of Natural Resources (MNR) is responsible for the protection of sensitive terrestrial and aquatic habitats and for aggregate pit and quarry approvals.

Ministry of Agriculture, Food and Rural Affairs (OMAFRA) has responsibility, through the Drainage Act, for drainage improvements involving agricultural lands. The Act is administered through local municipalities. Disputes are resolved through the Ontario Drainage Tribunal. Drainage works may affect shallow ground water systems and interfere with shallow ground water supplies.

Conservation Authorities obtain their mandate from the Conservation Authorities Act. Responsibilities include management of valleylands and flood plains on a watershed basis. They have an interest in the maintenance and control of stream flows.

District Health Units administer Ontario Regulation 358 under Part VIII of the Environmental Protection Act under agreement with MOEE and have a mandate under the Health Protection and Promotion Act to ensure safe potable water.

Regional Municipalities are empowered by legislation specific to each Regional Municipality. Generally, they are responsible for providing regional services such as water, sewage treatment, roads, waste management etc. These services may vary from one region to another.

The District Municipality of Muskoka has responsibilities similar to those of Regional Municipalities.

Local Municipalities (Counties, Townships, Local Service Areas) have responsibility for local planning and in some unorganized areas of the province assume some responsibilities of District or Regional Municipalities such as waste management.

Other Agencies include:

Ontario Clean Water Agency (MOEE)
Niagara Escarpment Commission (MOEE)
Waterfront Regeneration Trust (MMA)
Office of The Greater Toronto Area (MMA)
The Greater Toronto Area District (MNR)
Federal Government (Dept. of Fisheries and Oceans)

The above noted government agencies have an interest in hydrogeological studies in support of land development applications for the following reasons:

a) to ensure that no land use conflicts will occur;
b) that the health and safety of individuals and the community as a whole are protected; and
c) that the natural environment is protected.

Most of the above agencies do not have the technical capabilities to review hydrogeological studies and rely upon the MOEE for technical review comments on studies submitted in support of land development proposals. Some agencies with a significant interest in ground water issues, such as the Regional Municipality of Waterloo and some Conservation Authorities, have hydrogeologists on staff to provide technical review of hydrogeological studies to ensure the interests of the respective agencies are met.

The MOEE has the legislative mandate for ground water and surface water protection and management, and plays a leading role in the hydrogeologic review of development applications.

The mandates of MNR and the Conservation Authorities overlap to some extent with that of the MOEE. Since an overlap exists, coordination of interests and close communication among agencies is essential to recognize and resolve potentially competing interests. This requires that

during plan development, each agency's mandate and responsibilities are clearly understood and articulated.

Not all of the above noted agencies will have an interest in hydrogeological studies for each development application. This will depend upon the specific circumstances or ground water issues surrounding each application. Local municipalities should be familiar with the general planning issues. They will be able to provide guidance to proponents of development applications for agency contacts for more detailed technical information regarding specific issues.

2.1.5 Why are Hydrogeological Studies Required?

Land use changes may result in changes to the quantity and quality of ground water naturally occurring beneath a property as well as that of adjacent properties. Hydrogeological studies are required in support of development applications involving a change in land use to ensure that ground water quantity or quality and its users will not be adversely affected and that existing users of the groundwater are not adversely affected. In some cases, existing or past land use may have resulted in adverse ground water impacts. In such cases hydrogeological studies are required for purposes of redevelopment of a property. The scope of investigations depend upon the severity of the impacts and the proposed use of the property.

2.1.6 When are Hydrogeological Studies Required?

Hydrogeological studies may be required in support of development applications for a number of different reasons as outlined below. These studies are generally completed in support of Official Plan Amendments, and prior to draft approval for plans of subdivision and condominium. This applies to industrial, commercial, institutional and residential developments. Although hydrogeological studies are not normally required for 'consent to sever' applications, municipalities and their equivalents should give serious consideration to hydrogeological investigation of areas that are likely to be developed by consent over a period of time. This work would help in ensuring that the development would not create adverse affects on the groundwater.

The most common circumstances which would require a hydrogeological study include:

a) a development requiring a ground water supply, either individual, communal or municipal;

b) a development serviced by a sewage system(s) requiring subsurface disposal of sewage effluent via leaching beds for individual, communal or municipal systems, or via surface disposal using spray irrigation from a sewage lagoon;

c) proposed development sites having known or suspected soil and/or ground water contamination from either on-site or off-site sources; and

d) proposed development sites which are located on hydrogeologically sensitive areas.

The effects of land development on ground water recharge has become an issue for development applications. This will, in some cases, require an evaluation of the ground water recharge characteristics of properties proposed for development and the potential effects the proposed development may have upon the shallow ground water system. Studies of this type are of interest to the Conservation Authorities and the Ministry of Natural Resources in recognition of the interrelationship between shallow ground water systems and surface waters. This type of investigation is likely to be required in areas of high infiltration and on the Oak Ridges Moraine. Hydrogeological studies can be categorized according to specific issues such as those noted above. In addition there are broad planning based studies which are prerequisite to the site specific hydrogeological studies for development application approval. The major studies involving hydrogeological issues associated with land development applications include:

a) **Servicing Options Statement** - required to establish type of sewage and water servicing and is a prerequisite to site specific hydrogeological studies related to on-site sewage and water servicing.

b) **Water Supply Assessment** - required to evaluate availability of ground water supply and impacts of water taking for development on existing ground water users.

c) **Water Quality Impact Risk Assessment** - required to assess the ground water impact of on-site sewage systems utilizing subsurface disposal of sewage effluent to the ground water quality and risk to existing and/or potential groundwater users.

d) **Site Suitability For Sewage Effluent Disposal** - investigation of site conditions for suitability of subsurface sewage effluent disposal; this is usually completed as part of c) above.

e) **Site Decommissioning Study** - required to assess extent of ground water and soil contamination and remedial actions required of a property known or suspected of contamination from existing or previous land uses either on or adjacent to the property. This is often required for redevelopment of industrial properties but could also include other land uses.

f) **Groundwater Recharge (Infiltration) Study** - required to determine the impact of the proposed development on ground water recharge which is an important factor in maintaining stream flows and aquifers, particularly in areas of high infiltration (i.e., areas of sandy or gravelly soil).

g) **Special Areas Studies** - special areas include areas of Provincial Interest such as the Niagara Escarpment Planning Area and the Oak Ridges Moraine and areas of regional or local interest such as watersheds and/or subwatersheds. Technical planning studies for these areas have a broader focus than individual development applications and require regional or municipal wide analyses. Specific agencies such as the Niagara Escarpment Commission, the Office of the Greater Toronto Area (MMA), the Greater Toronto Area Branch (MNR) and Conservation Authorities are responsible

for establishing the requirements of such studies. Local municipalities will, in most cases, be able to provide guidance to proponents of development applications within special areas for appropriate agency contacts in regards to special study requirements. Where regional hydrogeological studies have been completed in such areas, they will provide a definition of the regional hydrogeologic setting and may provide guidance for site specific studies in support of individual development applications.

h) **Oak Ridges Moraine Studies** - the Oak Ridges Moraine is recognized as a major groundwater recharge area. Comprehensive analysis and groundwater management strategies are required to ensure maintenance of the recharge capacity and groundwater quality of aquifer systems in the moraine (technical studies are underway). A comprehensive analysis will be required for secondary plans and major Official Plan Amendments within existing urban and rural settlements. Development outside settlement areas will require a comprehensive municipal analysis of the need for this form of development and an assessment of the long term cumulative impacts on the natural environment including the protection of the integrity of ground water quality and quantity. Study requirements in support of development applications are outlined in the '*Implementation Guidelines, Provincial Interest on the Oak Ridges Moraine Area of the Greater Toronto Area, June 1991.*'

Hydrogeological studies in support of development applications will be reviewed by the MOEE and possibly other agencies depending upon the nature of the study. Comments will be submitted to the planning approval authority which in most cases is the MMA.

The complete development application with supporting documents and studies must, however, be submitted by the proponent directly to the area municipality or designated planning authority as part of the planning approval process. The appropriate review agencies will be asked to comment on various aspects of the development application in accordance with their respective legislative mandates. Coordination of this review process for most development applications is

generally the responsibility of the MMA. In some cases the MMA may designate responsibility for certain development applications to another planning authority. Applicants should contact their local municipality for guidance on specific development applications.

2.2 WHO SHOULD BE CONTACTED?

The main contact for a proponent of a development application is the local municipality or designated planning authority for the area in which the development is proposed. The local municipality will, in most cases, be able to advise a proponent of the other agencies who should be contacted for further assistance in determining site specific issues or study requirements. Agencies who may have an interest in hydrogeologic studies are noted in Figure 1.

The local municipality will be able to provide information relating to their requirements for specific studies in support of development applications and may in some cases be able to provide background information on a municipal wide basis. This information could include concerns such as:

a) areas of natural and scientific interest (ANSIs);
b) environmentally sensitive areas (ESAs);
c) woodlots;
d) sensitive or significant fishery resource areas;
e) wetlands;
f) flood prone areas;
g) regionally significant features such as the Oak Ridges Moraine (ORM) or the Niagara Escarpment Planning Area (NEPA); and
h) areas with little or no overburden.

The municipality will also be able to identify the location of municipal wells and existing and closed or abandoned municipal and/or private landfill sites. In some cases, completed hydrogeological reports may be available for these facilities. The municipality may also have information from other development applications within the vicinity of the proposed development. This could be a valuable source of information where hydrogeological studies have been completed. Copies of completed hydrogeological reports for previous development applications may be on file at the municipality or the Regional Office of the MOEE. These reports, where

HYDROGEOLOGICAL STUDY AGENCY REVIEW AND APPROVAL PROCESS

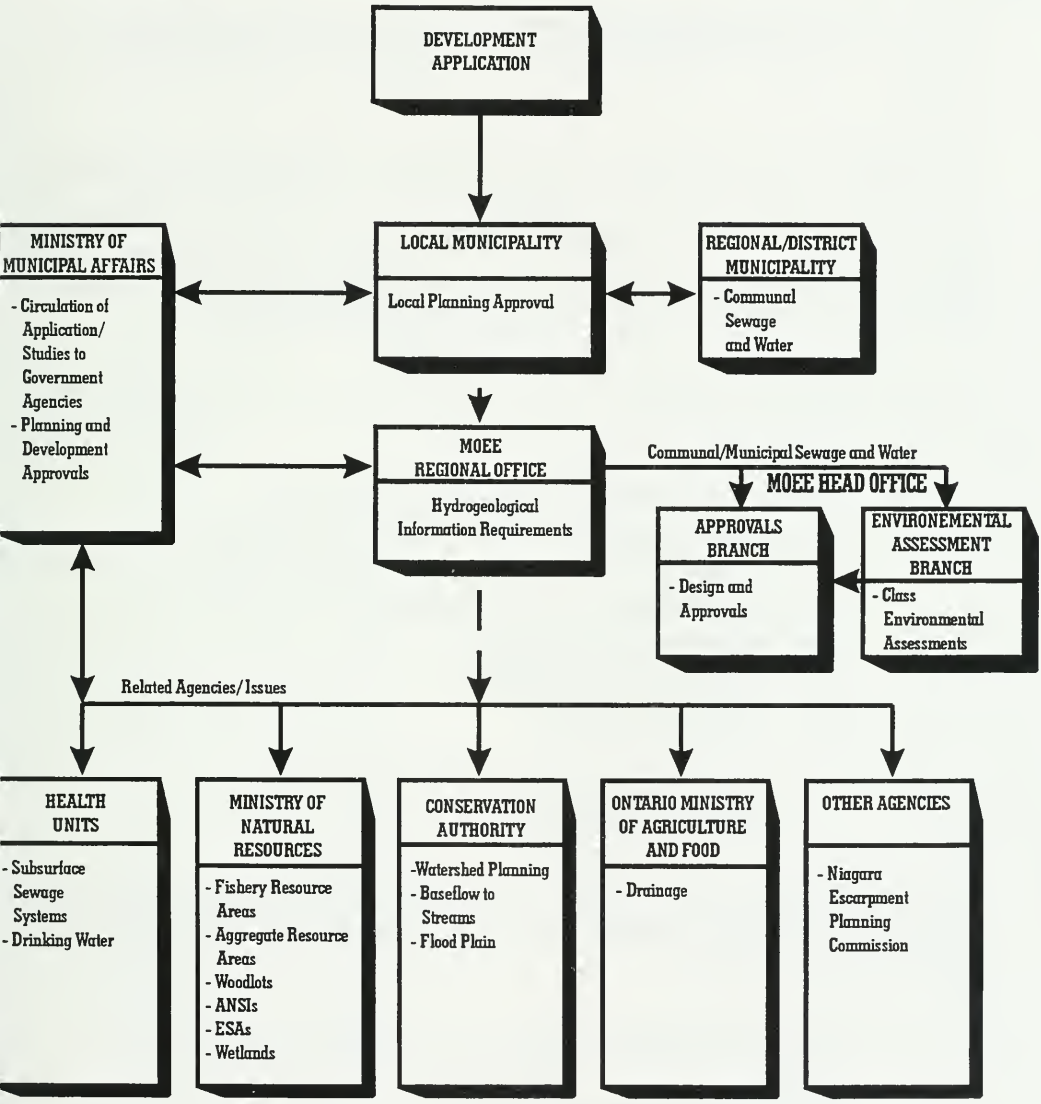


FIGURE 1

MOEE HYDROGEOLOGICAL TECHNICAL INFORMATION REQUIREMENTS FOR LAND DEVELOPMENT

available, may provide supplementary information on the local and regional hydrogeologic setting; however, they do not replace the need for hydrogeological studies for a new development proposal.

The Regional Office of the MOEE is the main contact for hydrogeological information requirements in support of development applications. This office will be able to provide specific information requirements for a particular development application. A list of Regional MOEE Offices is provided in **Appendix A** along with a map showing the Regions. The Regional MOEE Office is also a major source of hydrogeological information including:

a) Water well records;
b) Permits to Take Water;
c) Well interference complaints;
d) Records of spills and/or known sources of contamination;
e) Background hydrogeological reports and maps by the former Water Resources Branch (available through MOEE Information Resource Centre, Toronto, Ontario, listed in **Appendix B**);
f) Hydrogeological reports in support of
    i) past development proposals,
    ii) municipal landfill, and
    iii) municipal water taking
    (these reports may or may not be on file at the MOEE Regional Office).

The MOEE Regional Office may also advise the proponent to contact other agencies who may have an interest in ground water issues as they relate to their mandates. This would include but not be limited to the following:

a) Regional Municipalities (communal water supplies and sewage systems);
b) Health Units (subsurface sewage systems);
c) Ministry of Natural Resources (fishery resource areas, aggregate resource areas, woodlots, ANSIs, ESAs, wetlands);
d) Conservation Authorities (watershed planning, base flow to streams);

e) Ontario Ministry of Agriculture and Food (drainage works); and
f) Other agencies (e.g., Niagara Escarpment Planning Commission).

Other branches within the MOEE may also become involved where communal/ municipal sewage and water systems are proposed. This could involve:

a) Approvals Branch (design and approval); and
b) Environmental Assessment Branch (class EA for communal sewage and water facilities).

The specific interests and roles of the above agencies are described in the accompanying guidance document.

3 IDENTIFY THE ISSUES

CHAPTER 3

IDENTIFY THE ISSUES

The agencies described in the previous chapter will be able to provide a definition of their specific interests in a development proposal and will also clarify, where possible, specific concerns that need to be addressed. These concerns quite often involve the potential for off-site as well as on-site impacts as a result of a proposed development. For example, concerns regarding adverse impacts on a nearby stream or wetland may need to be addressed. The property of the proposed development will therefore need to be described in the context of its surrounding. The physical relationship or linkage of a property to adjacent or nearby areas will need to be established where the issue of sensitive or significant natural features in nearby areas is a concern.

3.1 RELATIONSHIP OF PROPOSED DEVELOPMENT TO ADJOINING AREAS

Ground water is part of the hydrologic cycle. It is dynamic, moving naturally through the subsurface environment and ultimately discharging at the surface. An understanding of the natural movement of ground water is important in undertaking an assessment of the potential effects of a proposed development. The environmental relationships are shown schematically on Figure 2. Areas that are upgradient of the development proposal or areas from which ground water is moving toward and beneath the property should be identified. If, for example, there is a known or suspected source of contamination upgradient of the subject property, such as an abandoned landfill site, industrial site, sewage lagoon etc., the physical linkage, if any, between the ground water system beneath the source of contamination and the subject property should be defined as part of the areal context. Even where no such sources of contamination are present, the physical relationship of upgradient areas to the subject property must be sufficiently understood to determine which areas can reasonably be expected to influence or contribute to the

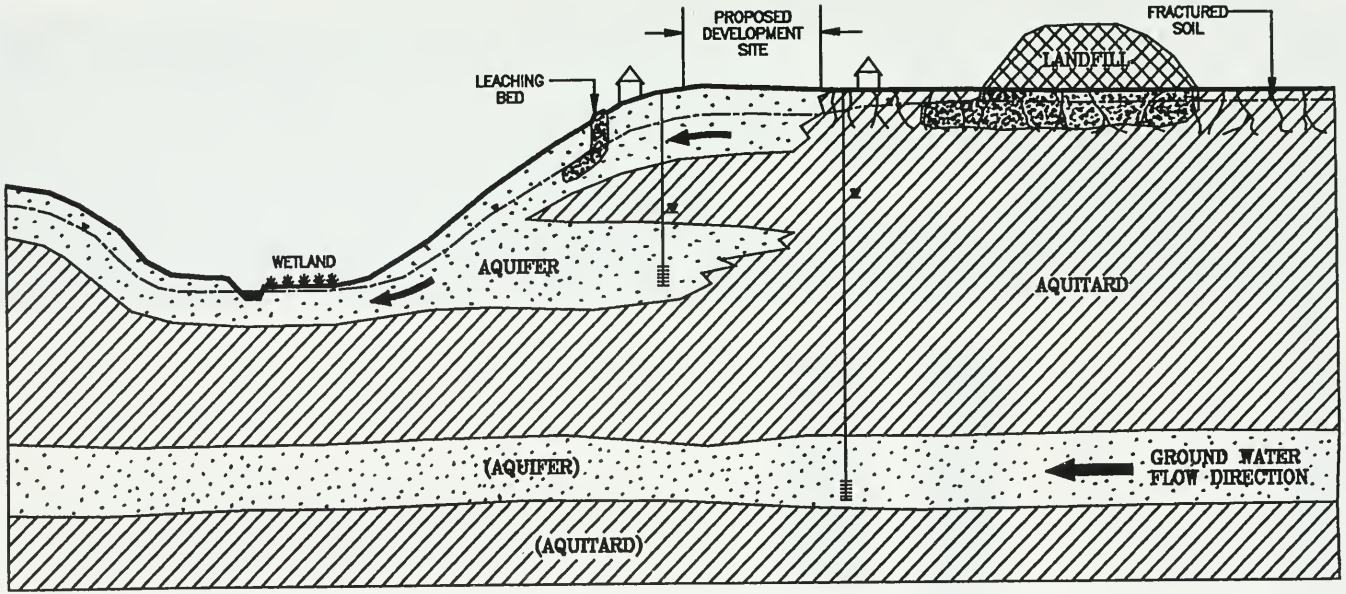
ground water resource beneath the subject property. Similarly the areas which are hydrogeologically downgradient of the property or areas that can potentially be adversely influenced by activities on the subject property must also be defined. This could include not only ground water resources but also surface features such as wetlands, streams and fishery resource areas that may rely upon ground water flow to sustain them.

The area around a property which must be included in defining these off-site linkages will depend, to some extent, upon the subsurface conditions and the sensitivity of the natural environment. The MOEE technical guidelines for hydrogeological assessments for water supply and sewage systems suggest that, at a minimum, an area within 500m of the edge of the property be included in the assessments. Larger areas may be required on a case by case basis where circumstances warrant.

A ground water resource or aquifer which extends off-site of a property may be used by others. The proposed use of an aquifer beneath a property could potentially affect adjacent areas, not just those that are upgradient or downgradient. Therefore, adjacent areas in all directions of a proposed development should be included in a hydrogeological assessment, particularly where on-site ground water resources will be required for the development.

The relationship of a proposed development area to adjacent areas can, in most cases, be established on the basis of existing information such as air photos, soil maps geological/ hydrogeological maps and reports and water well records. Plotting of well record locations and the interpretation of subsurface conditions from geological cross sections constructed through the subject property can be valuable tools in defining the physical hydrogeological linkages between the property and adjacent areas. The degree to which this can be achieved depends upon the availability and reliability of well records or available test drilling data for a given area. In some cases, where reliable data are lacking and there is significant concern regarding potential contamination from off-site, it may be necessary to confirm off-site subsurface conditions with test drilling.

The potential effects of a development proposal may, by themselves, be negligible. However, multiplying these effects over a larger area, such as a watershed, may result in adverse impacts. Examples of this would be a reduction in stream flows, temperature variations, nutrient enrichment etc. during critical times of the year. In certain areas, the larger scale effects of development may be of concern to agencies such as the Conservation Authorities.



LEGEND

- WATER LEVEL IN WELL
- WELL SCREEN INTERVAL
- GROUND WATER TABLE
- ZONE OF CONTAMINANTS
- (AQUITARD) — ZONE OF LOWER PERMEABILITY (i.e. FINE GRAINED SOIL, SILTS AND CLAYS)
- (AQUIFER) — WATER PRODUCING ZONE (i.e. GENERALLY COARSE TEXTURED SOIL, SANDS AND GRAVELS)

THE HYDROGEOLOGIC SETTING

Figure 2

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These concerns should be identified on a case by case basis through consultation with the appropriate agency at an early stage of the process. Specific direction may be provided by the agency(ies) in regard to their study requirements to address these larger scale issues, where they are a concern. A cooperative approach is required between agencies where overlapping jurisdictions are involved, to adequately define these concerns and to provide adequate direction to proponents of land development applications.

4 HYDROGEOLOGICAL STUDIES

CHAPTER 4

HYDROGEOLOGICAL STUDIES

4.1 MOEE TECHNICAL GUIDELINE DOCUMENTS

This chapter includes the technical hydrogeological information requirements of the MOEE based upon the most recent guidelines and policies available as of publication.

MOEE technical requirements for hydrogeological assessments pertinent to land development proposals are included in the following key guideline documents. They should be consulted prior to proceeding with detailed site investigations.

a) Technical Guideline for Individual On-Site Sewage Systems: Water Quality Impact Risk Assessment, MOEE;

b) Technical Guideline for Private Wells: Water Supply Assessment, MOEE;

c) Streamlining Regional Reviews of Submissions for Hydrogeologic Studies Supporting Applications for Large Subsurface Disposal Systems, and On-Site Subsurface Sewage Disposal Systems in Designated Areas, September 1992 with:

   i) Appendix A: Guidelines for Hydrogeological Reports Supporting Submissions for Large Sub-Surface Disposal Systems and On-Site Sub-Surface Sewage Disposal Systems in Designated Areas, MOEE, September 1992;

   ii) Appendix B: Screening Checklist to Accompany Submissions;

d) Streamlining Processing Applications for Permits to Take Water from Ground Water Supplies MOEE, September 1992 with:

   i) Appendix A: Guidance Documents for Information Required in Submissions for Permit To Take Water, including

      - Guidance Document for Information Required for the Review of Certificate of Approval and Permit To Take Water Applications for Communal Water Supplies, MOEE, September 1992;

      - Guidance Document for Information Required with an Application for a Permit To Take Water Associated with a Certificate of Approval other than a Communal Water Supply, MOEE September 1992; and

      - Guidance Document for Information Required with an Application for a Permit To Take Water Not Associated with a Certificate of Approval under the OWRA, MOEE, September 1992;

e) Guideline for Applying Policy 15-08 to Large Subsurface Disposal Systems, Appendix A, MOEE, Working Group V Water Management Steering Committee (Draft, February 1992); and

f) Manual of Policy, Procedures and Guidelines for On-Site Sewage Systems, MOEE, May 1982 (with periodic updates).

The information in this chapter is largely based upon the first two Technical Guidelines listed. With the exception of the last manual listed, all of the above documents are located in the Appendices at the end of this manual.

4.2 DETAILED ON-SITE INVESTIGATIONS

The local setting and on-site conditions are established from detailed field investigations. The general purpose of these investigations is to

a) confirm the local conditions;
b) establish the suitability of the property for the proposed development; and
c) determine the level of development that can be sustained without adverse or unacceptable ground water impacts.

The major components of on-site investigations will depend upon the type of sewage and water servicing proposed, the nature of the development and the hydrogeological issues associated with the subject property.

The hydrogeological site investigations in support of development applications on individual private services and outside existing settlement areas generally include the following major issues:

a)	**Water Supply**	-	ground water availability, quantity and quality
		-	ground water interference potential
b)	**Sewage Servicing**	-	soil and physical site suitability
		-	ground water/surface water impact assessment
c)	**Ground Water Recharge**	-	soil and site infiltration capacity
		-	impacts on ground water quantity and quality
		-	impacts on associated features such as wetlands, streams or natural areas

The most common components of on-site hydrogeological studies in support of land development applications include:

a) study of existing geological, hydrogeological and soil information,
b) soil testing and description through test pitting and/or soil borings,

c) ground water level measurement through ground water monitor and test well installation,
d) aquifer identification through test drilling,
e) aquifer testing through test well and observation well installation, pump testing, monitoring observation well(s) on-site and private wells (off-site) during pump testing,
f) ground water quality sampling from shallow ground water monitors, test wells and off-site private wells and laboratory testing of samples,
g) insitu hydraulic testing of saturated soil through ground water monitors, and
h) laboratory grain size analysis of soil samples.

The above noted information is used to:

a) interpret the hydrogeological conditions beneath the property,
b) calculate the quantity of ground water available for use on the property without significant adverse or unacceptable off-site effects,
c) determine the background ground water quality conditions on the site and possibly in adjacent nearby private wells and/or ground water monitors,
d) predict the level of ground water impact from subsurface sewage effluent disposal for critical contaminants or contaminants of concern,
e) assess the suitability of soil conditions and identify limiting factors on the property for sewage effluent disposal for purpose of sewage system design,
f) calculate or estimate the potential impact on the shallow and/or deep ground water system with respect to quantity and quality from the proposed development (i.e., effects upon ground water recharge), and
g) determine the extent to which predicted ground water impacts from the development will affect nearby or on-site natural features such as surface water, wetlands or natural areas.

4.3 WATER SUPPLY

Development proposals which require an on-site source of potable water will be required to complete a hydrogeological assessment to determine:

a) the availability and sustainability of adequate ground water supplies with respect to quantity and quality; and

b) the potential for interference between water supply wells, existing off-site and proposed on-site wells, existing or proposed sewage effluent disposal systems, and other uses (e.g., for maintenance of stream flows where applicable).

4.3.1 Communal/Municipal Water Supply

Hydrogeological information requirements, whether for individual on-site wells or communal/municipal wells, are similar. Development of communal/municipal wells will, however, require more stringent information requirements since the withdrawal rates from these wells are generally much higher than from individual private wells. Interference potential in the vicinity of a high capacity communal/ municipal well will be greater than within a comparable distance of an individual private (i.e., domestic) well. A Permit To Take Water is required for water takings in excess of 50,000 L/d which, in most cases, applies to communal/ municipal wells.

The hydrogeological report in support of a Permit To Take Water should include the following information as set out in the MOEE guideline entitled 'Streamlining Processing Applications for Permits To Take Water from Ground Water Supplies, September 1992':

a) the description of the hydrogeologic setting of the well(s);

b) location plot of the well(s), observation wells, test holes and area wells on the best available and appropriate scale (normally for areal well plots 1:10,000 maps should be used);

c) all local wells (recorded and unrecorded) should be tabulated with all relevant information (i.e., log, depth, static level, pumping water levels, pump setting, rated pumping capacity, screen(s)), and locations must be field checked;

d) at least two cross sections through the well(s);

e) estimate on the recoverable recharge in the area and comments on the potential of aquifer mining;

f) assessment of the susceptibility of the aquifer to contamination and the need for a well head protection area;

g) assessment of interference potential on ground water and surface water;

h) the well construction information should include:

i) well field design, distances between wells;
ii) a detailed well construction diagram indicating casing joints, groutings, wall thickness, screen slot size, length and diameter;
iii) elevation of measuring point of well(s);
iv) MOEE well logs for the proposed production well(s) and observation wells and test holes and vicinity supply wells;
v) step test (at least four to maximum capacity of well), prolonged aquifer test (at the design rate for at least 24 hours), static levels, elevation of measuring point, method of water level and flow measurement, orifice and pipe diameters and manometer heads;
vi) a pumping test analysis, such as Jacob's, with justification of selected methodology. The analysis should include time and drawdown for pumping and

recovery/ residual drawdown, as well as, distance-drawdown curves (if observation wells are available); estimate of the 20-year perennial yield and capability to supply the required amount specified in the design brief; comments on positive and negative boundaries;

vii) comment on method of disposal of pumped water during the test;

viii) well efficiency and well loss calculations;

ix) screen entrance velocity calculations;

x) comments on well alignment (plumbness and well alignment diagram) and sand-free condition testing;

xi) complete water quality analysis (chemical and bacteriological). Contact Regional Water Resources Unit for guidance;

xii) discussion of water quality problems and potential treatment; and

xiii) potential (nitrate) impact calculations on the proposed production well(s) and adjacent properties.

Recommendations should include but not be limited to:

a) Plan to overcome forecast interference (i.e., lower pump intakes, deepen or drill new wells, limit taking, etc.) including sufficient information to support feasibility of the approach.

b) Monitoring plan including specific targets (e.g., water level or other parameters) to trigger a "Contingency Plan" which will prevent interference.

c) The "Contingency Plan" must establish a process for dealing with validation and resolution of interference claims and include details for ensuring continuity of affected supplies (i.e., interim and permanent), including feasibility costs and proposals for "Financial Assurance".

In addition to the hydrogeological report, a Permit To Take Water Application will require an engineering design brief and well construction reports including water quality testing and proposed treatment. The engineering design brief and water supply details should be included as part of the required C of A application. The report and C of A application should be submitted together for concurrent review.

4.3.2 Individual Private Water Supply

Hydrogeological reports in support of individual private wells should include similar hydrogeological information as noted above. The requirements for pumping tests for individual private wells are not as stringent. An engineering design brief is not required, however, details on the well construction and pumping test results and analysis will be required. The following is an **annotated** description of the information requirements for water supply assessments for residential, industrial commercial or institutional developments where water is used for human consumption from individual private wells. The **annotations**, in italicized type face, are based on discussions with MOEE staff. They are included here for clarification purposes and are not included in the technical guideline documents. These information requirements are specifically for a water supply that does not require a Permit To Take Water or a Certificate of Approval.

(ANNOTATED) 'TECHNICAL GUIDELINE FOR PRIVATE WELLS: WATER SUPPLY ASSESSMENT, MOEE'

1.0 Statement Of Principles

This guideline describes the position of the Ministry of the Environment and Energy (MOEE) regarding the assessment of water supplies for developments on individual private wells. The Guideline is based on MOEE experience with development utilizing individual wells, and reflects the need to ensure that future owners of lots or homes have a high probability of being able to obtain adequate quantities of potable water for domestic consumption over both the short and long term.

For a large water supply system refer to "Streamlining Processing Applications for Permits To Take Water From Ground Water Supplies - MOEE, September 1992".

TECHNICAL GUIDELINE FOR PRIVATE WELLS: WATER SUPPLY ASSESSMENT (continued)

"Large water supply system" means a system which supplies water to more than five residences (ref. OWRA RSO 1990, A.52(8)(C). Large systems are also known as communal water supplies and municipal water supplies.

This guideline is presented for use with the understanding that the use of individual private wells has been justified by the municipality or the local planning authority. This justification includes an evaluation of alternative types of servicing. The Ministry encourages municipalities to plan for environmentally appropriate servicing infrastructures by undertaking comprehensive, large-scale assessment of ground water and surface water resources (see the Provincial Comprehensive Set of Policy Statements, particularly Policy Statement B7, *Planning for Sewage and Water Services*, and the Implementation Guideline to Policy Statement B7).

It is expected that the municipality will have made planning decisions about the disposition of its lands with respect to the type of servicing which is appropriate to the kind of development they wish to encourage. This work must have been completed before any technical studies for individual on-site systems would be accepted for review by the Ministry. The rationale is to ensure that the municipalities are responsible for their own development objectives and decisions. This paragraph is more broadly discussed in the above noted umbrella policy statement to which this guideline is attached as an appendix.

The objective here is to ensure that planning activities undertaken or endorsed by municipalities (or their equivalents) are not based on private individual water and sewage servicing alone. This basic form of servicing should be included with other planning" considerations, such as garbage collection, road maintenance, fire protection access to schools (to bus or not to bus), policing, and a host of other expectations that residents would have. Large lot sizes (implicit in private servicing) would result in high property taxes if all of the services were to be provided. More to the point, land use becomes much more inefficient, and is counter to the direction being endorsed by the Province with respect to land use planning.

MOEE Guideline B-1-1, "*Water Management, Policies, Guidelines, Provincial Water*

TECHNICAL GUIDELINE FOR PRIVATE WELLS: WATER SUPPLY ASSESSMENT (continued)

Quality Objectives of the Ministry of Environment and Energy", is made under the authority of the Ontario Water Resources Act (OWRA). Guideline B-1-1 deals with the protection and enhancement of drinking water quality as describes the Provincial Water Quality Objectives (PWQOs) and the Ontario Drinking Water Objectives (ODWOs). The primary purpose of Guideline B-1-1 is to protect public health and encourage the provision of aesthetically pleasing water. Water intended for human consumption should not contain any disease-causing organisms or hazardous concentrations of toxic chemicals or radioactive substances. Aesthetic considerations also provide a basis for drinking water objectives since the water should be pleasant to drink.

Reference should be made to the most recent version of ODWO which is currently October 1993. This could be expected to be revised periodically.

The document referred to as "Water Management Policies, Guidelines, Provincial Water Quality Objectives of the Ontario Ministry of the Environment and Energy" is also known as the "Blue Book". The Blue Book was revised in summer 1994 and reprinted in January 1995.

Although MOEE does not normally review development proposals consisting of five or fewer private residences, the Ministry recommends that supplies serving five or fewer private residences should use the ODWOs to ensure the quality of drinking water[1]. This recommendation may apply to development by consent or at the official plan amendment stage in certain areas; contact the local MOEE Regional office for further information. The Ontario Water Resources Act, RSO 1990, obliges the MOEE to comment on the quality of private water supplies which are part of development proposals submitted to the MOEE for review.

Ontario Regulation 903 establishes standards and regulations concerning well construction.

With respect to proposals involving individual on-site sewage systems (subsurface sewage systems), a separate guideline for the assessment of the impact of such systems on adjacent lands is available from the MOEE office in your Region. The title of the Guideline is *Technical Guideline for Individual On-site Sewage Systems: Water Quality Impact Risk*

[1] See "Ontario Drinking Water Objectives", Ontario Ministry of the Environment and Energy

TECHNICAL GUIDELINE FOR PRIVATE WELLS: WATER SUPPLY ASSESSMENT (continued)

Assessment.

With respect to communal water supply systems to serve more than five private residences, a Certificate of Approval, and possibly a Permit To Take Water will be required. For communal sewage systems, a Certificate of Approval will be required. For more information on communal systems, please contact the MOEE office in your area.

Refer to "Streamlining Processing Applications For Permits To Take Water From Ground Water Supplies", MOEE September 1992.

2.0 Objectives

The objectives of this guideline are as follows:

- to provide technical guidance to professionals involved in land development (in particular, hydrogeologists) in the assessment of ground water quality and quantity;

  Professionals generally means all individuals involved in or interested in land use planning. Use of the guidelines by a wide audience should assist in eliminating some of the delays experienced in the planning process, and should also result in a better informed public.

- to provide an interpretation of the application of MOEE policy to development of individual private well water supplies; and
- to ensure that development proposals are submitted with the required technical support.

3.0 Application

The guideline applies to all development proposals for residential development involving individual well water supplies. Development agreements between the proponent and the municipality, or its equivalent in unorganized areas, shall be used to bind development to the recommendations of approved hydrogeology studies.

TECHNICAL GUIDELINE FOR PRIVATE WELLS: WATER SUPPLY ASSESSMENT (continued)

The MOEE regional office will be able to assist in determining whether the supply should be looked at as a communal supply or a private individual supply.

The guideline also applies to developments for which a plan of condominium is required and to industrial, commercial or institutional developments where water is used for human consumption. Please contact your regional MOEE office for information on the applicability of the guideline to a particular development of this type.

4.0 Information Requirements

4.1 General

A hydrogeological study will be required by MOEE prior to recommendation of draft approval for plans of subdivision and condominium, and may be required prior to approval of official plan amendments which would permit development on private services. The study must be performed and a report submitted to the MOEE at the time of circulation of the proposed official plan amendment or plan of subdivision. The report must address concerns relative to the following:

- Future residents must be provided with water for domestic consumption that is of acceptable quality and of adequate quantity.

Sections 10, 28 and 29 OWRA, RSO 1990 provide legislative responsibilities regarding water. Guideline B-1-1 (Water Management Policies, Guidelines, Provincial Water Quality Objectives of the Ministry of Environment, Revised May 1994), commonly referred to as the "Blue Book", is aimed at the protection of water quality and quantity for human consumption and protection of aquatic life. The OWRA is the legislative authority for this Policy.

- Appropriate well construction techniques must be followed in order to minimise the possibility of well water quality degradation.

Regulation 903 sets all the requirements for well construction. Work is currently under way by the MOEE to reflect the application of Regulation

TECHNICAL GUIDELINE FOR PRIVATE WELLS: WATER SUPPLY ASSESSMENT (continued)

903 to monitoring wells, boreholes for geotechnical testing and to the use of ground water heat pumps.

- There must be minimal adverse effects on well water in the development from sources of contamination on the site or on adjoining lands.

- Developments must not result in water quantity interference conflicts between users in the development and users on the adjoining lands.

With respect to quality, each future domestic well must provide water that is safe and aesthetically suitable for human consumption. The suitability of the water for domestic use is determined by comparing the results of the analysis of ground water samples from test wells with the applicable ODWOs (see "Water Well Quality Testing" below).

With respect to quantity, each future domestic well must provide sufficient water for normal domestic purposes (see "Well Water Quantity Testing"). This will be determined mainly on the basis of data from pumping tests in test wells.

After its initial review of a hydrogeological study report, the MOEE may advise the consultant and the proponent that additional information be supplied, or recommend that further work be done. The advice and recommendations must not be construed as conditions of approval but rather as suggestions for those cases where the proponent wishes to continue to pursue approval. Ultimately, it is the hydrogeology of the site itself which will determine whether a proposal is acceptable.

When a report is found to be incomplete, draft or preliminary, or makes unsubstantiated claims, the MOEE will advise the proponent by letter with regard to the report's deficiencies. The MOEE may not undertake a full review until such time that a complete report (i.e., one which satisfies the requirements of this Guideline) has been submitted.

The underlying purpose of this guideline and the companion sewage guideline is to eliminate the need for repeat reviews of hydrogeological documents provided in support of development proposals. The hydrogeology studies should be sufficiently detailed and complete to enable recommendation of draft approval for the

TECHNICAL GUIDELINE FOR PRIVATE WELLS: WATER SUPPLY ASSESSMENT (continued)

proposed plan. Any outstanding problems with the studies should be sufficiently minor in nature to enable them to be resolved through conditions of draft approval.

As noted in the sewage guideline it is preferred that both the water supply study and the sewage impact assessment be submitted together for review. The intent of the requirement that both the water and sewage impact assessments be submitted together is to ensure that the site has been properly evaluated in terms of its ability to supply potable water and treat sewage. It is important that these two studies be completed in conjunction with each other, either by one consultant or by two consultants. The problems that can arise from not doing this are 1) density considerations that are not based on potential impact on the ground water, 2) water assessment that is completed without taking into consideration the potential for impact from the sewage systems.

4.2 Test Well Requirements

Site assessment for water supplies from wells must be undertaken as follows:

i) The minimum number of test wells will be:

- 3 for sites up to 15 hectares in area;
  4 for more than 15 and up to 25 hectares;
- 5 for more than 25 and up to 40 hectares;
- for more than 40 hectares, one additional test well for each additional 20 hectares or portion thereof.

The above are suggested minima unless otherwise justified.

Where the hydrogeology is well known and conditions are consistent in the area (and where there are other supporting data from wells of similar construction and in the same water bearing formation) the information may be used to complement test wells and provide the required level of confidence. The consultant will have to provide clear justification for use of data collected from existing wells and for not using the minima noted in the guideline. The consultant may wish to consider

TECHNICAL GUIDELINE FOR PRIVATE WELLS: WATER SUPPLY ASSESSMENT (continued)

preconsultation with regional MOEE hydrogeology staff.

Where development by severance is considered, determination of the availability of a potable water supply should be made as early as possible in the severance approval process.

In areas where ground water quantity or quality are considered marginal with respect to domestic requirements, as many as one test well per lot may be required;

ii) The areal distribution of test wells must be such that hydrogeological conditions across the site are adequately represented. Depending on the areal configuration and hydrogeological complexity of the site, more than the minimum number referred to in section i) may be required;

iii) Consideration must be given to past or present land uses. Existing improperly abandoned wells should be identified since they may impact on ground water. Moreover, any contaminant spills on or adjacent to the site which may affect water quantity or quality should be identified and evaluated for their impact on ground water.

The hydrogeologist's report should include recommendations for proper abandoning of existing improperly abandoned wells, test wells which are not used for subsequent water supply and any existing water supply wells on site which will not be used for water supply in the future. Where there is an imminent risk of impact on ground water quality or personal safety, the consultant should immediately advise the MOEE and his client regarding the risk.

The test well(s) should be located in an area which would permit a proper assessment of these impacts;

iv) Test wells must be located and constructed in such a way as to permit the prediction of the quantity and quality of ground water which domestic wells will supply in the future. Accordingly, the construction of these wells must

TECHNICAL GUIDELINE FOR PRIVATE WELLS: WATER SUPPLY ASSESSMENT (continued)

be typical of wells which will be used in the development in the future, and must comply with Ontario Regulation 903, with the requirements of other jurisdictions, and with any additional specifications recommended by the consultant and/or MOEE.

Consideration should be given to having at least one of the test wells drilled to depth to determine the stratigraphic sequence and the presence of deeper aquifer zones. This information can then be used in determining the preferred aquifer to ensure longevity of the water supply.

Existing water wells located on the site or in the immediate proximity of the site may be used as test wells, provided they fulfil i) to iv) above, and are fully incorporated into the well water quantity and quality testing programs described in the sections below. The use of existing wells and of the data obtained from them must be justified in the report as being technically appropriate; however, there must be at least one test well, new or existing, located on the site.

Wells which are to be used must have a water well record and where available geophysical logs. The integrity of the well and its record are essential to ensure that comparison is being made on the basis of reliable information, and that wells being established on the development site will not be compromised.

If the consultant and licensed well contractor properly locate and construct the test wells, or if there are pre-existing wells on the property which meet the requirements of iv) above, the developer may use them later as domestic water wells. They must, however, yield potable water and meet the construction requirements indicated in the approved study recommendations, which are implemented by provisions in the development agreement between the municipality (or its administrative equivalent) and the proponent. If any such wells are not to be maintained for future use, they must be properly abandoned as required by Ontario Regulation 903; abandonment must be recommended in the hydrogeological study report and must be implemented by the development agreement. To ensure that the recommendations of the report are properly implemented, the consultant's report may include recommendations for supervision of well construction by a qualified consultant at

TECHNICAL GUIDELINE FOR PRIVATE WELLS: WATER SUPPLY ASSESSMENT (continued)

the time the well is being constructed by the (licensed) well contractor.

4.3 Well Water Quantity Testing

Each of the test wells must be subjected to a pumping test. The tests may be done sequentially, using the other wells as observation wells, or several wells could be pumped simultaneously. The report must contain all well logs, Water Well Records, raw pumping test data and graphs, and hydrogeological cross section(s), and must discuss the sustainability of domestic well yields, the potential for supply interference and site aquifer characteristics such as hydraulic gradient, transmissivity and boundary conditions. (Note that in most cases where on-site sewage systems are proposed, the impact assessment requires a determination of the hydraulic gradients.)

Consideration should be given to pumping a test well at the combined water demand rate (if possible) in order to clearly demonstrate the capacity of the aquifer to supply the anticipated demands.

4.3.1 Pump Test Procedure

The following pumping test procedure is recommended:

- the test wells should be fully developed prior to the pumping test in order to avoid unacceptable turbidity levels at the time of sampling;

Some useful data may be obtained by monitoring water levels during the pumping test/well development process.

Consideration should be given to completing step tests on test wells in order to assess well efficiency. It is important to use a step test to assess well efficiency.

If the water taking during the test will exceed 50,000 L/day a temporary Permit To Take Water will be required for this type of test. The MOEE Regional Office should be contacted in advance. Sufficient information and time should be given to MOEE staff for evaluation and issuance of the Permit if required. If this

TECHNICAL GUIDELINE FOR PRIVATE WELLS: WATER SUPPLY ASSESSMENT (continued)

technique is to be used, consideration must be given to where the pumped water is to be discharged, in order to avoid recharge of the pumped aquifer and any other adverse environmental impacts. Consideration must also be given to potential off-site impacts on off-site ground water users.

- the pumping test must begin with a static water level and must be perfor med at a fixed rate (±5%) for a minimum period of six hours[2] (longer where supplementary storage systems are necessary) of "continuous" pumping (no stoppages); water levels must be monitored in the test well and observation wells at an appropriate frequency; water must be discharged at an appropriate distance from the test wells to ensure that artificial recharge does not occur;

- immediately following the pumping test, water level recovery must be monitored in the test wells until 95% recovery occurs or for 24 hours, whichever is less; where sufficient recovery does not occur, the issue of the long-term safe yield of the aquifer is especially significant and must be addressed; and

- the test rate will be at least the minimum rate discussed below (also see "Raw Water Quality" below).

4.3.2 Calculation of Minimum Test Rate and Well Yield

The minimum pumping test rate and well yield required for a particular development must be calculated as follows:

The per-person requirement shall be 450 litres per day. Peak demand occurs for a period of 120 minutes each day[3]. This is equivalent to a peak demand rate of 3.75 litres/minute for each person. The basic minimum pumping test rate is this rate multiplied by the "likely number of persons per well" which, for a single family residence, shall be the

[2] The minimum duration of six continuous hours incorporates safety factors with respect to seasonal variables.

[3] Refer to page 5 of the MOEE publication entitled "Water Wells & Ground Water Supplies in Ontario", 1989. The per-person daily demand use here is the upper limit of the estimated range.

TECHNICAL GUIDELINE FOR PRIVATE WELLS: WATER SUPPLY ASSESSMENT (continued)

number of bedrooms plus one. Unless it is otherwise established to MOEE's satisfaction, a minimum of four bedrooms shall be used in the calculation. However, regardless of the results of this calculation, this rate shall not be less than 13.7 litres /minute.

Where lawn and garden irrigation is contemplated consideration should be given to pumping the well at a higher rate than indicated above.

It is recommended that test wells be pumped at or near their maximum capacity in order to better determine the aquifer characteristics.

The only instance where rates lower than these may be used is where preliminary results indicate that the pumping test rate cannot be sustained in the long term, and consideration is given to systems which would compensate for low well yields. In this case, the rate of test pumping may be decreased, but the duration must be proportionately increased such that the total amount pumped equals the amount that would have been pumped if the test had been conducted using the procedures and minima discussed above. The yield requirement must then be applied to the well and to the compensatory system on a daily basis. These systems and any special water treatment devices that may be necessary for their proper functioning must be fully described in the report.

A compensatory system may include storage and repressurization. It is recommended that the storage system be sized to compensate for peak daily use, irrigation (if contemplated) and emergency storage to allow for repair of a failed pump.

Regardless of whether systems to compensate for low yields are required, the report must demonstrate that future domestic wells will sustain repeated pumping at the test rate and duration at 24-hour intervals over the long-term.

Where a test well can safely provide water at the calculated rate, it is not acceptable to conduct pumping tests at low rates and subsequently recommend the use of systems to compensate for low well yields simply in order to limit the migration of poorer quality water into the well.

TECHNICAL GUIDELINE FOR PRIVATE WELLS: WATER SUPPLY ASSESSMENT (continued)

Consultants must provide a statement indicating that, in their professional opinion, the probable well yields determined on the basis of their investigations are representative of the yields which residents of the development are likely to obtain from their wells in the long term.

4.3.3 Additional Information

Shallow wells and unconfined aquifers are susceptible to seasonal fluctuations in water level. In these cases, the consultant must address this issue and may need to perform additional investigations to determine the possibility of future well water quantity problems.

Ground water heat pumps which do not return water to the aquifer of origin are not permitted. If treatment systems which require additional amounts of water for their operation are to be used, those rates must be added.

> *It is recommended that the consultant address the potential impact on water quality of the return of water from ground water heat pump systems to the aquifer of origin. (regulation and policy with respect to ground water heat pump systems is under development.)*
>
> *Typical treatment systems requiring "additional water" would be water softeners and reverse osmosis units.*

Consultants should address the issue of whether the ground water withdrawals in the proposed development and in other existing or planned developments in the area will exceed the long-term safe yield of the aquifer, or significantly decrease baseflow to sensitive water courses (trout streams, etc.). Relevant information may be available from the local planning authority, other ministries and agencies, municipal offices, and local residents.

Where there is established development in the vicinity, information from residents and other sources regarding well yield problems (water shortages, replacement wells etc.) should be obtained.

TECHNICAL GUIDELINE FOR PRIVATE WELLS: WATER SUPPLY ASSESSMENT (continued)

4.4 Well Water Quality Testing

4.4.1 Raw Water Quality

The consultant must obtain and analyze sufficient water quality samples during each pumping test in order to determine the physical, chemical and bacteriological quality of the water. At least one sample must be collected during the last hour of the test. The consultant may wish to obtain additional samples during the pumping test.

It is the consultant's responsibility to address water quality changes over time and to demonstrate that the water quality data are representative of the quality of water which future residents can expect in the long term.

Prior to any testing for water quality, there must be no chlorine residual. Chlorine residual tests must be performed at the well head at the time that bacteriological samples are obtained, and must be reported.

> *This requirement assumes that the well and/or well drilling and testing equipment has been chlorinated prior to testing.*

Where there are wells in nearby established developments, information should be obtained from residents, where possible, and other sources regarding water quality problems. If on-site sewage systems are used in the existing development(s) and are also to be used in the proposed development, well water samples from the existing development should be obtained and analysed. The consultant should use this information to predict the impact of the proposed on-site sewage systems on water quality within the proposed development.

Water quality may vary between aquifers or with depth in the same aquifer. The consultant should recommend appropriate well construction (see "Well Construction" below) and must comment on the potential for cross-contamination between aquifers.

Shallow and/or unconfined aquifers are susceptible to contamination from sources located at or near the ground surface. If wells are to be constructed within such aquifers, and especially where individual on-site sewage systems are also proposed, the consultant must

TECHNICAL GUIDELINE FOR PRIVATE WELLS: WATER SUPPLY ASSESSMENT (continued)

address the risk of contamination and recommend measures which will reduce that risk.

The minimum set of parameters for which the analyses must be performed is listed in the Appendix, along with the applicable Ontario Drinking Water Objectives. Other parameters, such as heavy metals, pesticides, tannins, sulphide, phenols, and fluoride, may be required by the Regional MOEE office in your area. Please contact the office for more information. The consultant must also determine whether conditions specific to the site or its surrounding area require the inclusion of additional parameters. Complete documentation of sampling times, any on-site analytical methods, and all analytical results must also be included in the report.

If methane or other potentially explosive gases are encountered during the water supply assessment, the consultant must make recommendations to adequately control this hazard.

Note: Where health-related ODWOs or treatment limits for aesthetic ODWOs have been exceeded, the areas which the relevant test wells represent may have to be excluded from the proposed development site. In this case a justification for the selection of the boundary of the site is required.

4.4.2 Treatment Systems

For some aesthetic parameters, the ODWOs may be exceeded provided that concentrations are below the treatment limits noted in Table 3. The Appendix lists these parameters, the limits for treatment and some comments on treatment methods. In cases where raw water sodium levels exceed 20 mg/L, warning clauses should be addressed to people on sodium restricted diets and should be registered on title. In addition, if water softening is utilized to reduce hardness, a warning should be registered on the title with a recommendation that a separate tap, which by-passes the softener, be installed to supply unsoftened drinking water.

If the raw water from the wells exhibits values for aesthetic parameters that are above the ODWOs but below the treatment limits, or if supplemental storage systems are proposed which require special treatment systems, the municipality's assent to development based on treatment systems must be obtained prior to submission of the hydrogeological report

TECHNICAL GUIDELINE FOR PRIVATE WELLS: WATER SUPPLY ASSESSMENT (continued)

to MOEE. A copy of a Resolution of Council must be appended to the report (see Implementation below).

> *Based on the aesthetic parameters in the ODWO, a council resolution will be required where ever iron exceeds 0.3 mg/L. Since this is common throughout much of Ontario, it would appear that council resolutions will be needed in many cases.*

If treatment is required, "Comments on Treatment" listed in Table 3 of the Appendix are provided for the purpose of assisting applicants and municipalities in deciding whether development based on treatment systems should proceed. Prior to the municipality considering approval of the development proposal and/or Official Plan Amendment, it is the applicant's responsibility, based on advice from a qualified consultant, to satisfy the municipality that the concept of using treatment systems is appropriate. MOEE staff will not comment on the acceptability of the various proprietary treatment systems available.

The treatment systems mentioned in Table 3 of the Appendix are suggested for treatment for single parameters. When treatment for more than one parameter is required, the systems suggested may not be appropriate due to treatment process interferences. The consultant must supply recommendations regarding the type of treatment required.

4.5 Well Construction

Construction specifications for future domestic wells in the proposed development must be addressed by the consultant in the hydrogeological report. Minimally, the construction of both the test wells and future domestic wells must comply with Ontario Regulation 903 made under the Ontario Water Resources Act, and with municipal requirements - where applicable.

When on-site sewage systems are proposed, or when they already exist on adjacent property, protection of the wells from contamination by effluent must be addressed.

When shallow and/or unconfined aquifers are to be used, the consultant must recommend construction specifications and well locations to address the issue of the susceptibility of such aquifers to contamination from sources at or near the ground surface.

TECHNICAL GUIDELINE FOR PRIVATE WELLS: WATER SUPPLY ASSESSMENT (continued)

Well locations must be selected in order to minimize the impacts on the location of leaching beds on adjoining lots.

The consulting hydrogeologist should try to work with the planner or site engineer in producing the development plan. Well and sewage systems would then be incorporated at an early stage in the site design, thereby optimizing site resources for water supply and sewage treatment. Storm water management should also be taken into consideration when siting a well and a sewage system.

Water quality may vary between aquifers or with depth in the same aquifer. The consultant should recommend appropriate well construction, methods and requirements, and must comment on the potential for cross-contamination between aquifers.

The consultant or the MOEE may wish to recommend additional site-specific construction criteria and/or supervision of well construction by qualified staff. In studies in which the consultant's initial findings show that water quality or quantity standards cannot be met without special well construction specifications, the initial data which led to these conclusions must be included in the report. The structure of the test wells on which the final quantity and quality data are based must meet these specifications and the wells must be tested according to the procedures stipulated in this Guideline, in order for the data to be deemed representative.

Subsections 13(2) and 13(3) of Ontario Regulation 903 require that wells be constructed such that the casing of a drilled well protrudes at least 30 centimetres above ground surface or above the floor of a well pit. Well water contamination caused by the entry at the well head of water originating at or near the surface may occur if the well head is buried. Subsection 20(3) requires that the well owner maintain the well in a manner sufficient to prevent such contamination. Where well heads are buried, locating, inspecting and servicing the well are difficult and expensive.

Subsections 13(2), 13(3) and 20(3) are often contravened when, after a well is constructed, contractors or residents bury the well head for reasons of convenience or aesthetics. Contractors and residents should be reminded of the intent and requirements of these portions of the Regulation, and of their responsibility to ensure that the finished grade of

TECHNICAL GUIDELINE FOR PRIVATE WELLS: WATER SUPPLY ASSESSMENT (continued)

the ground surface allows the casing to protrude the required distance. This is necessary to prevent ponding at the well head or, in the case of well pits, prevents flooding of the pit. Where flowing well conditions occur, the requirements of Regulation 903 must be met.

Because of the importance of the situations noted in the last two paragraphs of this section, it is recommended that the consultant address these issues in the hydrogeology report and make the appropriate recommendations.

The municipal concern with proper well construction and abandonment of any previously existing unused wells and/or test wells is that ground water contamination be prevented. Ground water contamination can occur from the movement of contaminated surface water into an open well or down the sides of an improperly constructed well. Old corroded well casings may also allow ground water movement between water bearing zones and may act as conduits for contaminant movement.

4.6 Land And Water Use Conflicts

Land uses within a minimum of 500 m of the site must be described. Where wells exist on or adjacent to the site, a survey of well owners, static and pumping levels and sampling and analysis of representative well water, should be performed and reported. The potential for an adverse impact on the development must be addressed, when there have been, are, or may in the foreseeable future be significant potential sources of ground water contamination (e.g., from old, operating or proposed waste disposal sites, road salt storage facilities, farming activities, locations of contaminant spills, etc.), or potential causes of quantity interference with ground water resources or well water supplies (e.g., from municipal wells, dewatering activities, etc.) within a minimum of 500 metres of the site. The issue of whether additional water quality parameters should be included in the testing must also be addressed.

4.7 Phased Developments

Where a development application relates to an additional phase of a phased development,

TECHNICAL GUIDELINE FOR PRIVATE WELLS: WATER SUPPLY ASSESSMENT (continued)

even though previous phases may already have been approved on the basis of previous hydrogeological studies which encompassed those phases or the entire site, a supplementary study and report is required. Water samples from wells that are located on nearby developed lots in previous phases that are in use and representative of the same formation, must be analysed for the required parameters, and the well owners should be interviewed regarding their experience with their well water quantity and quality. This information, as well as the Water Well Records and a map showing the locations of all wells in previous phases, must be provided. The original hydrogeological report must be re-assessed in light of the new information obtained and according to any new criteria or guidelines which may not have been in effect at the time of the original study. Where well water quality or well yield in the previous phases are not comparable to that found in the original test wells or predicted by the original hydrogeological study, the new study should investigate and explain the causes and provide new recommendations based on a re-assessment of the original report. Where new guidelines require information which is not included in the original report, the new report must provide it.

This paragraph does not apply to properties that are draft approved and are registered in phases unless provisions were made in the conditions of final approval for further studies.

If the new phase does not contain test wells from the original study, new ones must be installed. Where additional study involving new test wells is necessary, most or all of the criteria set forth in this Guideline will apply. Consultants should discuss these issues with MOEE staff before proceeding.

Data from the earlier phases of the development should be used to determine the scope of the additional study required.

5.0 IMPLEMENTATION

MOEE staff will implement this guideline through comments and advice supplied to municipalities, the public, and approval authorities on documents circulated under the Planning Act.

TECHNICAL GUIDELINE FOR PRIVATE WELLS: WATER SUPPLY ASSESSMENT (continued)

It should be noted that the MOEE will not recommend approval for official plan amendments and draft plans of subdivision or condominium unless the MOEE (or its agents) is satisfied that the hydrogeological report demonstrates that sufficient water is available. Where ground water of adequate quality and quantity is demonstrated to be available to service the proposed development, the MOEE will require, as a condition of final approval, that the MOEE receive a copy of a fully executed subdivision or condominium agreement or other suitable development agreement between the municipality and the developer, which requires that the recommendations of the hydrogeological report as approved by the MOEE (or its agents) be implemented. The municipality should ensure that MOEE comments have been adequately addressed within the fully executed agreement.

If groundwater open loop heat pumps are being considered for use in the proposed development, they must be included in the hydrogeological study to ensure that domestic potable water supplies will not be adversely impacted. If the issue of ground water heat pumps is not addressed in the report, MOEE will request that a condition be placed in the development agreement indicating that the use of ground water heat pumps has not been approved as part of the development.

Regulations and policy are being developed which may be used to provide direction on how ground water heat pumps are to be used.

The possibility of using systems to compensate for low well yields (for example, controlled pumping to supplementary storage) is discussed earlier in this Guideline. However, while the MOEE may provide technical guidance, it is the municipality's responsibility to decide whether development on the basis of such systems should be allowed. If the municipality agrees to their use, notification must be given through the development agreement between the municipality and the proponent(s). The municipality shares responsibility with the proponent(s) for ensuring that the terms of the development agreement are completed.

With respect to water quality, the following will apply (except for the 20 mg/L warning level for sodium):

- Where health and aesthetic ODWO criteria are met, MOEE will comment

TECHNICAL GUIDELINE FOR PRIVATE WELLS: WATER SUPPLY ASSESSMENT (continued)

favourably on approval of the Official Plan Amendment or on draft approval of the Plan of Subdivision or Condominium.

- Where health-related ODWO criteria are not met, MOEE will recommend against approval of the proposal on the basis of individual wells.
- Where health-related ODWO criteria are met but aesthetic objectives are exceeded, it may be possible to use in-home water treatment systems to reduce the values of the aesthetic parameter(s) concentrations to a level below the limits, and thereby meet the objectives.

This guideline lists concentrations considered treatable for several aesthetic parameters and some possible treatment systems (see Table 3 of the Appendix). However, it is the municipality's responsibility to decide whether development on the basis of in-home treatment systems should be permitted. If the municipality agrees to the use of in-home treatment systems, notification must be given through the development agreement between the municipality and the proponent(s). The municipality also shares responsibility for ensuring that the terms of the development agreement are carried out. Accordingly, where treatment systems are required, a copy of the municipality's Resolution of Council specifically assenting to the use of treatment systems in the development must be appended to the hydrogeological study report.

Where health objectives are exceeded or where treatment limits for aesthetic objectives are exceeded, the local municipality and the approving authority should only consider development on the basis of a communal water system. MOEE approvals are required for Water Works for municipal and communal systems, as defined under the Ontario Water Resources Act and set out in MOEE Guideline B-14, "Treatment Requirements for Municipal and Communal Water Works Using Groundwater Sources." The municipality shall assume ownership of and responsibility for the water works following completion.

6.0 DEFINITION

Individual wells:

Private water wells supplying five or fewer residences (or the equivalent for other types of development) are referred to in this guideline as "individual wells".

TECHNICAL GUIDELINE FOR PRIVATE WELLS: WATER SUPPLY ASSESSMENT (continued)

7.0 REFERENCE DOCUMENTS

Other documents that should be used in conjunction with this Guideline include:

- "Comprehensive Set of Policy Statements", Province of Ontario;

  - Policy Statement B7, "Planning for Sewage and Water Services", Ontario Ministry of Environment and Energy (MOEE);
  - Policy Statements B8 through B11, "Growth and Settlement", Ontario Ministry of Municipal Affairs (MMA).

- "Implementation Guidelines to the Comprehensive Set of Policy Statements", Province of Ontario

  - Implementation Guideline to Policy Statement B7, "Planning for Sewage and Water Services", Ontario Ministry of Environment and Energy (MOEE);
  - Implementation Guideline to Policy Statements B8 through B11, "Growth and Settlement", Ontario Ministry of Municipal Affairs (MMA).

- "Technical Guideline for Individual On-Site Systems: Water Quality Impact Risk Assessment", MOEE.
- "Water Management - Policies, Guidelines, Provincial Water Quality Objectives of the Ministry of Environment and Energy", MOEE Guideline B-1-1 (July 1994).
- Ontario Water Resources Act, RSO 1990.
- "Water Wells & Ground Water Supplies in Ontario", MOEE 1989.
- Regulation 903, made under the Ontario Water Resources Act.
- "Levels of Treatment for Municipal and Private Sewage Treatment Works Discharging to Surface Waters", MOEE Guideline F-5.
- "Treatment Requirements for Municipal and Communal Water Works Using Groundwater Sources", MOEE Guideline B-14.

A full copy of the preceding guideline is attached in Appendix C with attached reference tables.

4.4 SEWAGE SYSTEMS

Development proposals which propose to employ on-site subsurface sewage disposal systems will be required to include a terrain analysis and hydrogeological assessment to determine:

a) the suitability of the site conditions for subsurface sewage systems;
b) the potential impacts on the ground water system on-site and off-site; and
c) what monitoring, mitigation or contingencies are required.

The information requirements for assessing the suitability of site conditions for large and small subsurface sewage systems are contained in:

"Policy Procedures and Guidelines for On-site Sewage Systems", MOEE, 1982 (periodically updated).

The above document includes the requirements for:

a) assessing site suitability;
b) location and design; and
c) licensing and approval procedures.

The hydrogeological information requirements pertaining to impact assessments, monitoring, mitigation and contingencies are outlined in the following discussion.

4.4.1 Municipal Sewage System

Full scale municipal sewage systems that would serve a new development proposal would, in most cases, not involve ground water issues related to the sewage and water services. In this case, it is anticipated that sewage services are provided by sanitary sewers and a sewage treatment facility located some distance from the subject property. Hydrogeological assessments may however be required to address ground water recharge quantity and quality issues as well as potential impacts on streams.

4.4.2 Communal Sewage System

A communal sewage system, for purposes of this discussion, is considered to be a large subsurface sewage disposal system, which is defined in MOEE Notice 3/87 as follows:

a) has an average daily flow greater than 4,500 L/d;

b) serves more than five private residences/ dwelling units, with a communal subsurface sewage system; or

c) services more than five private residences/ dwelling units with adjacent individual sub-surface sewage systems and which will be located in a municipality or an area of a municipality designated by the Part VIII Director, and/or the Regional Director of the Ministry of the Environment; or

d) serves any institution, industrial or commercial establishment;

but does not include a sub-surface sewage system that:

i) serves an institutional, industrial or commercial establishment with an average daily flow less than 4,500 L/d whose waste water consists solely of sewage of domestic origin, which is human body waste, toilet or other bathroom waste, and liquid or water-borne culinary sink waste.

Communal or large subsurface sewage disposal systems are subject to MOEE Policy 15-08 which defines the acceptable levels of ground water impacts for such systems. The hydrogeological information requirements in support of communal subsurface sewage systems is outlined in the following documents:

a) Streamlining Regional Review of Submissions for Hydrogeologic Studies Supporting Applications for Large Subsurface Disposal Systems, and On-Site Subsurface Sewage Disposal Systems in

Designated Areas, MOEE September 1992; includes two Appendices as follows:

Appendix A: Guidelines for Hydrogeological Reports Supporting Submissions for Large Sub-Surface Disposal Systems, and On-Site Subsurface Sewage Disposal Systems in Designated Areas.

Appendix B: Screening Checklist for Hydrogeologic Studies Submitted in Support of Applications for Large Subsurface Disposal Systems and On-Site Subsurface Sewage Disposal Systems in Designated Areas.

b) Guideline For Applying Policy 15-08 to large Subsurface Disposal Systems, Appendix A, MOEE Working Group V Water Management Steering Committee (Draft, February 1992).

Hydrogeological reports in support of developments utilizing communal subsurface sewage systems must include (but may not necessarily be restricted to) the following information as outlined in the above noted documents:

Physical Setting

a) Provide regional and local maps which show site location and orientation with Lot and Concession Numbers. Use topographic maps of 1:10,000, 1:25,000 or 1:50,000 scale, from Ontario Base Mapping or National Topographic Series. Use maps of the scales that best describe the site and that best show its location.

b) Describe topography and surface drainage conditions, as well as adjacent wetlands, watercourses and flood plains within at least 500m of the site. Make use of maps to clearly locate these features.

c) Identify surrounding land uses and types of servicing, and identify on-site land use. Use maps to depict this information.

d) A clear description of the hydrogeological setting using maps, borehole logs, soil types at various depths and cross sections.

e) Identify any ground water sources, any aquifers and any water uses in the area.

f) Identify and provide references to all applicable studies/ reports available for the area.

Impact Assessment

a) Include an assessment of the potential risk to ground water resources through an evaluation of the migration of the effluent. A definition of the most probable contaminant migration pathway must involve a standard hydrogeologic assessment of the site incorporating test pits, auger holes, well records, test drilling and/or other means. This assessment must consider the entire site as well as surrounding lands.

b) All assessments must involve a description of the ground water sources including aquifer/ aquitard physical parameters and existing/ potential uses. Aquifer uses are not necessarily restricted to anthropogenic uses (for instance, supply base flow to a cold water stream). Such uses may involve water quality criteria more stringent than the Ontario Drinking Water Quality Objectives.

c) The determination of the potential for impact on the ground water resources will be dependent upon definitions of:

   i) the degree of isolation between the proposed disposal systems and any ground water supply; and
   ii) the expected attenuation of contaminants within the subsurface.

d) Where there is a potential for surface water impact, the proponent

is required to address the concerns of the Regional Surface Water Unit.

e) The hydrogeologic study will determine the impact potential of the subsurface disposal system on the ground water at the site boundary. **The critical contaminant at the predicted boundary must comply with MOEE Guideline B-7 (formerly Policy 15-08).**

Monitoring Program and Contingency Plan

a) Unless justification is provided otherwise, a monitoring program is required and it must conform with standard hydrogeological practices.

b) Unless justification is provided otherwise a contingency plan is required. Included should be pre-determined levels identified in the monitoring program that will activate the contingency plan.

4.4.3 Individual On-Site Sewage Systems

On-site sewage systems with subsurface disposal of sewage effluent will require:

a) an assessment of ground water impacts, and
b) a soil investigation to determine the suitability of the property for sewage effluent leaching bed construction.

The latter will involve an assessment of shallow on-site soil conditions, depth to ground water table, depth to bedrock and terrain conditions. The soil information requirements for determining suitability for sewage effluent leaching bed construction are contained in the MOEE Manual of Policy, Procedures and Guidelines for On-Site Sewage Systems, Chapter 6. The focus of the soil investigation is to assess the hydraulic capabilities of the on-site soils for subsurface sewage effluent disposal. This information is used for sewage system design. The Local Health Units will review the soil investigation results as a requirement for approval of the proposed

development. The Local Health Unit will also require followup site specific soil information at the detailed design and construction stage to confirm sewage system design at individual leaching bed locations.

The hydrogeological information requirements for assessing ground water quality impacts of individual on-site sewage systems are outlined in the following MOEE document.

The following is an **annotated** version of the above noted document with explanatory, notes based upon discussions with MOEE staff involved in the formulation of the above noted document. The **annotations** are shown in italicized type and are included for clarification purposes. **Annotations** are not part of the technical guideline.

(ANNOTATED) 'TECHNICAL GUIDELINE FOR INDIVIDUAL ON-SITE SEWAGE SYSTEMS: WATER QUALITY IMPACT - RISK ASSESSMENT MOEE'

1.0 STATEMENT OF PRINCIPLES

This guideline describes the position and requirements of the Ministry of the Environment and Energy (MOEE) regarding the assessment of the potential impact on ground water caused by proposed developments on individual on-site sewage systems (sub-surface sewage systems). This guideline applies only to those areas of the Province which have not been designated under Notice 3/87 (attached) as subject to Ministry Guideline B-7 (formerly 15-08). In areas so designated, the proposed development must comply with the requirements of Guideline B-7 and its associated guidelines.

Development consists of every land use that is serviced by individual small systems including residential, commercial, industrial and institutional. Seasonal and recreational properties are included and are considered in the same regard as properties which would have year round occupation.

TECHNICAL GUIDELINE FOR INDIVIDUAL ON-SITE SEWAGE SYSTEMS (continued)

The guideline reflects the Ministry's experience with development utilizing individual on-site sewage systems, and emphasizes the need to minimise the potential for adverse ground water impacts resulting from their use.

> *This guideline is applied only to individual on-site systems which have flows of less than 4,500 Litres per day and do not fall under the requirements of Guideline B-7.*

This guideline is presented with the understanding that the use of individual on-site sewage systems has been justified by the municipality or the local planning authority. This justification includes an evaluation of alternative types of servicing. The Ministry encourages municipalities to plan for environmentally appropriate servicing infrastructures by undertaking comprehensive, large-scale assessment of ground water and surface water resources. See the Provincial Comprehensive Set of Policy Statements, particularly Policy Statement B7 *Planning for Sewage and Water Services*, and the Implementation Guideline to Policy Statement B7.

> *It is expected that the municipality will have made planning decisions about the disposition of its lands with respect to the type of servicing which is appropriate to the kind of development it wishes to encourage. This work must have been completed before any technical studies for individual on-site systems would be accepted for review by the Ministry. The rationale is to ensure that the municipalities are responsible for their own development objectives and decisions. This paragraph is more broadly discussed in the 'Policy on Planning for Sewage and Water Services' to which this guideline is attached as an appendix.*

> *The objective here is to ensure that planning activities undertaken or endorsed by municipalities are not based on private individual water and sewage servicing alone. This basic form of servicing should be included with other considerations such as garbage collection, road maintenance, fire protection, access to schools (to bus or not to bus), policing, and a host of other expectations that residents would have. Large lot sizes (implicit in private servicing) would result in high property taxes if all of the services were to be provided. More to the point, land use becomes much more inefficient, and is counter to the direction being endorsed by the Province with respect to land use planning.*

TECHNICAL GUIDELINE FOR INDIVIDUAL ON-SITE SEWAGE SYSTEMS (continued)

The purpose of the guideline is to protect the environment and public health by ensuring that development utilizing individual on-site sewage systems proceeds at a density and scale which will not result in, or cause degradation of, ground water resources in exceedance of acceptable limits. Compliance with acceptable limits shall be demonstrated through a prediction of the development's nitrate impact on the ground water at the development boundary. The Guideline is intended to encourage the assessment of the potential for degradation on the basis of a technically based and technically defensible evaluation of the proposal.

For the purposes of this paragraph, development boundary refers to the edges of the property defined in the planning document. These edges are normally the surveyed lines which delineate the property proposed for development through the requirements of the Planning Act.

The guideline has been assembled with the recognition that each proposed development *site has finite resources available to treat sewage, and that the resources are highly variable from one location to the next. The resources may even be highly variable on the development site itself. Preparation of hydrogeological studies prior to draft approval being granted will allow a realistic expectation of the number of lots that can be obtained on a site before a great deal of money has been spent doing surveying, engineering drawings and a variety of other things normally done as part of the planning and development process. If the studies reveal at this stage in the process that existing on-site conditions are not suitable for individual servicing, the proponent will have the ability to explore other options (e.g., communal servicing) without already having spent the amount of time and capital associated with conditions of draft approval. This approach would allow environmental realities to be met while reducing serious economic exposure for the proponent.*

2.0 OBJECTIVES

The objectives of this guideline are as follows:

a) To provide technical guidance to professionals involved in land

TECHNICAL GUIDELINE FOR INDIVIDUAL ON-SITE SEWAGE SYSTEMS (continued)

development (in particular, hydrogeologists) in assessing the potential for unacceptable ground water impacts resulting from the use of individual on-site sewage systems, through a three stage assessment process.

Professionals generally means all individuals involved in or interested in land use planning. Use of the guidelines by a wide audience should assist in eliminating some of the delays experienced in the planning process and should also result in a better informed public.

b) To ensure that proposals are submitted with the required technical support to allow the Director to either support the proposed development, designate the proposed development under Notice 3/87 (thus requiring an assessment in compliance with Guideline B-7 and its associated guidelines), or to recommend against approval.

Here, "Director" would normally mean the Ministry of Environment and Energy Regional Director and/or his/her staff.

3.0 APPLICATION OF THE GUIDELINE

This guideline applies to the combined or total impact on ground water of a development proposal of more than five units with individual on-site sewage systems, in areas which have not been designated under Notice 3/87 (attached). The Guideline applies to residential, commercial and industrial proposals which use individual on-site sewage disposal systems for the treatment of domestic waste. Application to development proposals involving five or fewer units shall be at the discretion of the Regional Director. Although MOEE does not normally review development proposals consisting of 5 or fewer lots, municipalities are encouraged to retain, on their behalf, professionals with demonstrated expertise in hydrogeology with emphasis on development on private services, to review studies prepared in accordance with this Guideline. Municipalities are also encouraged to implement the provisions of this guideline in their consideration of developments by consent or severance.

This guideline does not apply to the following:

TECHNICAL GUIDELINE FOR INDIVIDUAL ON-SITE SEWAGE SYSTEMS (continued)

a) Large Subsurface Sewage Disposal Systems as defined in Notice 3/87 (attached);

Those systems with average daily sewage flows of over 4,500 Litres per day are referred to as 'large systems'.

b) the assessment of impacts of existing isolated individual residential sewage systems or interference between individual home systems on existing neighbouring lots within a subdivision (see Note below);

Impacts of subsurface sewage systems proposed for use on existing lots of record may be required on a case-by-case basis. Lots of record means lots which had been developed and/or approved some time in the past prior to the application of hydrogeological guidelines for the determination of appropriate development densities. Lots of record may also be lots that were more recently created by plans of subdivision. In this case, those lots would in all likelihood would have resulted from plans of subdivision which were subjected to hydrogeological assessment.

If the lots were created by a plan of subdivision for which hydrogeological assessment had been part of the subdivision approval process, then the approved recommendations in the hydrogeology assessment would need to be followed. The recommendations would be implemented by requirements in the development agreement (a legally binding document) between the developer and the municipality. The agreement would be registered on title to the lands.

c) applications for approval of on-site systems which are replacements due to the failure (e.g., due to hydraulic load, age, etc.) of the original system.

This guideline may not apply to non-standard individual on-site systems which are specifically designed to reduce nitrate loadings. It should be emphasized that MOEE encourages the development of new technologies for the treatment of domestic sewage waste. The Ministry will entertain proposals for development which incorporate new technologies. Contact your regional MOEE office for information on these types of systems.

This paragraph means that additional work will be required and will likely involve a greater number of individuals than would normally be the case in the review of standard subsurface sewage systems.

For example, new technologies would require review and approval by MOEE's Approvals Branch. The concerns here are for both the continued protection of the environment and the continued ability of the system to function as designed over an extended period of time. Until new technologies have been adequately proven and endorsed by the Ministry, they will not be accepted for residential development. In some cases, new technologies are being tested for large systems used by schools.

Note: Where the use of individual on-site systems has resulted in unacceptable impairment of off-site water quality, the issue should be handled in accordance with MOEE Guideline B-9-1 (formerly Policy 15-10), "The Resolution of Groundwater Quality Interference Problems".

4.0 DESIGNATED AREAS UNDER NOTICE 3/87

Under Notice 3/87, the Director under Part VIII of the Environmental Protection Act or the MOEE Regional Director may designate a municipality or an area of a municipality as subject to Guideline B-7 (formerly Policy 15-08: "Incorporation of the Reasonable Use Concept Into MOEE Groundwater Management Activities").

It is important to note that even though an applicant may meet the requirements of the following Section of this Guideline, the Director reserves the right to require more detailed assessment or to designate any site or area of a municipality as subject to Guideline B-7 (formerly Policy 15-08) under Notice 3/87. The likelihood of this occurring is greater where:

a) conditions outlined in the 'General Evaluation' below are not met;

b) the development proposed has a higher density than previous development proposals in the municipality;

TECHNICAL GUIDELINE FOR INDIVIDUAL ON-SITE SEWAGE SYSTEMS (continued)

c) the scale of the proposal is such that an increased degree of assurance is appropriate; or

d) it is known that there are existing high levels of ground water contamination by nitrate-nitrogen.

When these environments are encountered or these developments are proposed, the Director's support may be conditional upon the establishment of monitoring programs and financial assurances. Under these circumstances contact the local MOEE Regional Office for more information.

Although the Director may support a proposal involving individual on-site sewage systems and permit their installation, the Director does not assume responsibility for failure of the system(s), for correcting the damage to adjacent properties, or for the construction of new sewage systems. This is the responsibility of the proponent/owner of the system.

5.0 GROUND WATER IMPACT ASSESSMENT IN NON-DESIGNATED AREAS

5.1 General Evaluation

The ground water impact assessment will address the ability of the lands, identified by and restricted to the development proposal document, to treat sewage effluent to meet acceptable limits. This assessment[4], and the assessment described in the "Technical Guideline for Private Wells: Water Supply Assessment", should be completed and submitted together as one document. Approval Authorities (i.e. the Ministry of Municipal Affairs and/or designate) should only consider support for development applications involving individual on-site sewage systems where the proponent and/or the consultant has:

The intent of the requirement that both the water and sewage impact assessments be submitted together is to ensure that the site has been properly evaluated in terms of its ability to supply potable water and treat sewage. It is important that

[4] Please note that this hydrogeologic study is not the assessment described in the MOEE "Manual of Policy, Procedures and Guidelines for On-Site Sewage System." That assessment determines the hydraulic capability of the soil to disperse effluent from a leaching bed on a continuous basis, and does not take into account the potential for contamination of the ground water. However, it is recommended that this impact prediction not be conducted in isolatioo from the requirements of this and other related guidelines.

TECHNICAL GUIDELINE FOR INDIVIDUAL ON-SITE SEWAGE SYSTEMS (continued)

these two studies be done in conjunction with each other, either by one consultant or by two consultants. The problems that can arise from not doing this are 1) density considerations that are not based on potential impact on the ground water, 2) water assessment that is done without taking into consideration the potential for impact from the sewage systems.

The underlying purpose of this guideline and the companion individual well guideline is to eliminate the need for repeat reviews of hydrogeological documents provided in support of development proposals. The hydrogeology studies should be sufficiently detailed and complete to enable recommendation of draft approval for the proposed plan. Any outstanding problems with the studies should be sufficiently minor in nature to enable them to be resolved through conditions of draft approval.

a) in conjunction with the municipality, defended the use of private services to the satisfaction of the MOEE Regional Director in accordance with the Provincial Comprehensive Set of Policy Statements, particularly, the Policy Statement and Implementation Guideline B7, *Planning for Sewage and Water Services*, and the Policy Statements and Implementation Guidelines B8 through B11, *Growth and Settlement.*

Satisfaction in this regard is provided by means of a letter from the municipality's council, accompanying the proposed development plan, which states that the municipality has, through its planning deliberations, decided that the use of individual subsurface sewage disposal systems is the municipality's preferred means of servicing.

b) demonstrated to the local Health Unit (or to the MOEE, in those areas where MOEE administers the Part VIII Program) that the site complies with the requirements of Ontario Regulation 358 and related policies and guidelines;

Where possible, the Health Unit is encouraged to provide copies of the results of its site visit to the MOEE Regional Office. These copies should be included for

TECHNICAL GUIDELINE FOR INDIVIDUAL ON-SITE SEWAGE SYSTEMS (continued)

consideration in review of the hydrogeology study by MOEE staff.

It would be very helpful to have a copy of comments provided by the Health Unit (or its equivalent) for use by the hydrogeologist preparing the study and for the MOEE hydrogeologist who would review the study. The soils information obtained through the Health Unit's site review would augment information obtained by the hydrogeologist (but must not be a substitute for the hydrogeologist's own data collection) and would be particularly useful for 1) soils information to depths that would be used for sewage system installation and 2) system locating considerations. This latter point is particularly important to the siting of wells. The information could be provided to 1) the municipal planning department (or its equivalent) for circulation to MOEE, 2) directly to the MOEE Regional Office, or 3) the hydrogeology consultant on the basis of a written request to the Health Unit (or equivalent).

c) determined the representative existing background nitrate-nitrogen levels in the receiving ground water. This determination will involve the collection of ground water samples from various locations on and adjacent to the development site. The consultant must provide a clear rationale for the number of times the site is sampled, the period of time over which the sampling has been undertaken (capturing seasonal variations), and the manner in which this information is used in the assessment. The consultant must discuss the existing background nitrate-nitrogen concentrations relative to nitrate sources, and the susceptibility of ground water to contamination.

The receiving ground water is normally the water table. This is the ground water which will receive impact from sewage system effluent. The testing of the ground water can be accomplished by use of test pitting where the ground water is relatively close to the surface, or by test wells where the ground water is not accessible by use of backhoe or other conventional methods for testing other relatively shallow ground water.

The consultant must provide justification for the number of samples and sample sites used in his/her evaluation of background nitrates. The consultant should use

TECHNICAL GUIDELINE FOR INDIVIDUAL ON-SITE SEWAGE SYSTEMS (continued)

information on land uses, physiographic characteristics and ground water flow directions in making this justification.

The Ministry will normally not support development in areas where background nitrate -nitrogen concentrations exceed 10 mg/L. Where nitrate concentrations between 0 and 10 mg/L are found, the MOEE may also decide not to support development if the proponent's consultant cannot provide a reasonable explanation for the existing levels of nitrate concentration in the ground water. However, if it can be demonstrated that existing levels of nitrates are the result of historical agricultural practices on the site (for example farming, feed lot, etc.), the proponent may be able to argue that the nitrate levels will decline after development, and;

d) demonstrated that the area is not obviously hydrogeologically sensitive (for example, karstic areas, areas of fractured bedrock exposed at surface, areas of thin soil cover, or areas of highly permeable soils).

The intent of this paragraph is to ensure that the water supply is adequately isolated from the sewage system. This is of particular concern in areas with existing water supplies developed in the sensitive zone.

This paragraph is meant to warn hydrogeologists that sites may not be suitable for sewage systems because of the high likelihood of adverse impacts on ground water. If development is contemplated in these areas, the consultant must be prepared to provide very strong rationalization of how development could proceed while safeguarding water supplies. The sites that exhibit hydrogeological sensitivity would require more in-depth study by consultants in support of development proposals.

It is not the intent of MOEE to promote the development of areas with high infiltration rates (for example, sandy overburden deposits). Due to lack of effective effluent treatment in highly permeable soils, individual on-site systems are usually not approved in soils which have very high infiltration rates.

The concern in this paragraph is that there is adequate protection of ground water

TECHNICAL GUIDELINE FOR INDIVIDUAL ON-SITE SEWAGE SYSTEMS (continued)

resources. Of note is the concern about increased mobility of pathogens through highly permeable materials. There is also growing widespread interest in protection of highly permeable areas as principal recharge areas for aquifers.

5.2 Three-step Assessment Process

Every proposed development involving individual on-site sewage systems requires an assessment of the ground water impact potential. The purpose of the assessment is to ensure that the combined effluent discharges from all the individual on-site sewage systems in a development will have a minimal effect on the ground water and the present or potential use of the adjacent property. For the purposes of this Guideline, the ODWO of 10mg/L of nitrate-nitrogen is used as an indicator of ground water impact potential. This Guideline does not define a precise methodology for determining the expected level of impact; however, it does set out the major considerations which should be included in a defensible assessment of the impact potential.

The assessment involves a three step process. The need to advance to the next step depends on the conditions defined in the previous step. The process is dependent on first satisfying the general requirements defined in "Designated Areas under Notice 3/87" and "General Evaluation" above.

The three step process is illustrated schematically in Figure 3.

The first step involves a definition of the proposed development's minimum lot size. If the minimum lot size is smaller than that defined in Step 1, below, the assessment must progress to the second step, which involves evaluating the relationship between the individual on-site sewage systems and the ground water. Where it cannot be demonstrated that the systems are isolated from exsisting or potential ground water supplies, it will be necessary to progress to the final step of the assessment, which involves a detailed examination of contaminant loading to the ground water.

Where a report is found to be incomplete, draft or preliminary, or makes unsubstantiated claims, the MOEE will advise the proponent by letter with regard to the report's deficiencies. MOEE may not undertake a full review until such time that a complete

TECHNICAL GUIDELINE FOR INDIVIDUAL ON-SITE SEWAGE SYSTEMS (continued)

report (i.e., one which satisfies the requirement of this Guideline) has been submitted.

Report requires: mapping at a suitable scale (such as 1:10,000), description of property location (municipality, township, lot, concession, and UTM coordinates for property), copies of original water well records or MOEE computer printouts, survey of any unrecorded wells, test pit logs (colour, texture, soil profile, grain size analysis, depth to water table), density, hydrogeologic cross-sections, plot of well locations, description of sampled or tested wells, surrounding existing and previous land uses, information on local water budget, infiltration rates, limiting layers, ground water flow directions, information on various water bearing zones.

5.3 Fundamental Considerations

a) For the purposes of this guideline, the only exceptions to the use of ground water for anything other than a drinking water supply shall be:

i) For reasonable uses which involve water quality more stringent than defined by the Ontario Drinking Water Objectives (for example: providing baseflow to a cold water trout stream), or

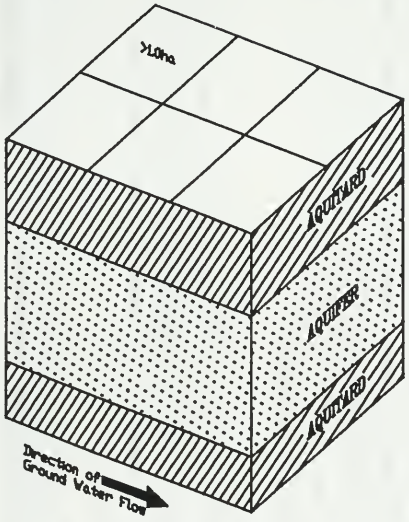
Baseflow quality is the concern in this section. The Ministry of Natural Resources should be contacted for comments on whether the stream would be subject to specific requirements for protection of fisheries.

If MNR has concerns about the adjacent water body, they should be provided in writing to the proponent, and submitted with the hydrogeological study as part of the planning document circulated by the municipality (or equivalent).

ii) At the Director's discretion.

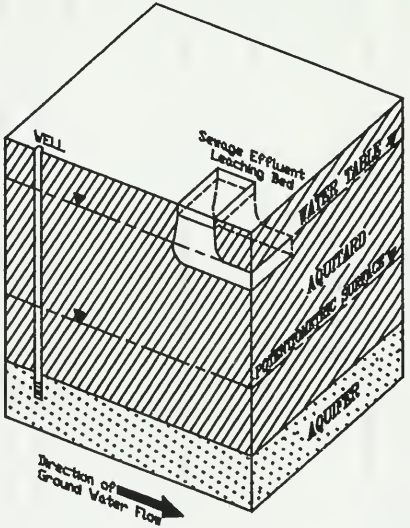
b) Ground water impact predictions shall be calculated for the development site property boundary.

STEP 1
LOT SIZE

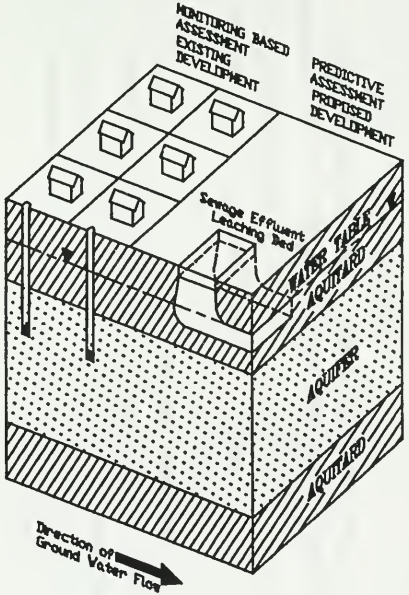


"MUST SHOW SITE IS NOT HYDROGEOLOGICALLY SENSITIVE"

STEP 2
SYSTEM ISOLATION



STEP 3
CONTAMINANT ATTENUATION



INDIVIDUAL ON-SITE SEWAGE SYSTEMS
WATER QUALITY IMPACT RISK ASSESSMENT

Figure 3

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TECHNICAL GUIDELINE FOR INDIVIDUAL ON-SITE SEWAGE SYSTEMS (continued)

c) The consultant must make recommendations regarding the optimum location and orientation of leaching beds. In general, the attenuative capabilities of a site can be optimized by maximizing separation distances between individual on-site systems and downgradient wells and property boundaries.

The location and orientation of leaching beds can have an impact on hydraulic competition between beds. Siting considerations should be included with the hydrogeological report to minimize the potential for interference between leaching beds and between leaching beds and wells. Storm water management should also be taken into consideration.

d) Where applicable, the impact of the on-site discharge of sewage effluent into surface water must be evaluated. This work must be done by qualified individuals and must address potential impact from phosphorus and other parameters which may be of concern (see the MOEE Guideline B-1-1 *Water Management - Policies, Guidelines, Provincial Water Quality Objectives of the Ministry of Environment and Energy*, and contact your local Regional Office). The concentration of phosphate used in assessing the potential impact of sewage effluent should normally be 15 mg/L.

Where surface water quality is of concern, assessment of potential impact of phosphorus will be needed. This concern is not applicable to all development applications. Information can be obtained from the MOEE regional office as to whether a surface water assessment is required. Consideration should be given to contacting the Ministry of Natural Resources to determine their concerns with respect to the water body.

5.4 Step One: Lot Size Considerations

For developments where the lot size for each private residence within the development is one hectare or larger, the risk that the boundary limits imposed by these guidelines may be exceeded by individual systems is considered acceptable in most cases. Developments consisting of lots which average 1 hectare (with no lot being smaller than 0.8ha), may not require a detailed hydrogeological assessment, provided that it can be demonstrated that

TECHNICAL GUIDELINE FOR INDIVIDUAL ON-SITE SEWAGE SYSTEMS (continued)

the area is not hydrogeologically sensitive. In such circumstances, it is the responsibility of the proponent to obtain a professional analysis from a qualified consultant that the area is not hydrogeologically sensitive.

It is assumed that attenuative processes within a one hectare lot will be sufficient to reduce the nitrate-nitrogen to an acceptable concentration in ground water below adjacent properties. It should be noted that sufficient attenuative processes may not be present in hydrogeologically sensitive environments, or where there is little water surplus available[5].

It is essential that a hydrogeologist be consulted for an opinion or evaluation as to whether a plan or part of a plan consisting of the density described in this section is located in an area that is hydrogeologically sensitive. This is to be done in writing, so that the MOEE planner will know whether to request further assessment under Step 2 or Step 3.

5.5 Step Two: System Isolation Considerations

Hydrogeologically isolated: those areas characterized by strong upward hydraulic gradients; massive, unfractured clay deposits at or near ground surface; or other thick layers of low permeability materials over water-bearing formations.

The rationale here is that sewage effluent would not be able to enter the ground water which will serve as the potable supply. It is important that the hydrogeologist be able to supply assurance that the "isolating feature" is widespread in terms of the plan under consideration, consistent in its thickness and integrity (i.e., absence of lenses, seams and fractures that would compromise its integrity) and that the upward gradient will not be reversed by pumping for domestic water taking.

Where proposed lot sizes are less than one hectare, the proponent and/or the consultant is/are responsible for assessing the potential risk to ground water. Developments will normally be considered as low risk where it can be demonstrated that sewage effluent is

5 Suitability of the lot for a sewage disposal system is also dependent on approval from the Director under Part VIII of the Environmental Protection Act. See the MOEE "Manual of Policy, Procedures and Guidelines for On-Site Sewage Systems."

TECHNICAL GUIDELINE FOR INDIVIDUAL ON-SITE SEWAGE SYSTEMS (continued)

hydrogeologically isolated from existing or potential supply aquifer(s). In making this assessment, the proponent and/or the consultant must:

a) evaluate the most probable ground water receiver for sewage effluent: its definition must be defended by hydrogeological data and information obtained through a test pit, auger hole and/or test drilling program; and
b) define the most probable lower hydraulic or physical boundary of the ground water receiving the sewage effluent.

The consultant must clearly define those portions of the subsurface which will be affected by the effluent. Detailed predictions of the shape of individual contaminant plumes and a description of specific contaminant concentrations over space and time may not be required.

The potential for isolation must be assessed on a site specific basis and may involve assessments of geologic and/or hydraulic boundaries. Please note that this may require hydrogeologic assessment of lands up to 500 metres beyond the actual development boundary.

Information obtained from surrounding lands may be used for overall assessment of the site in terms of existing water chemistry. This information will be of assistance to the hydrogeologist in corroborating information obtained from testing on the site of the proposed development.

In some cases, it may be necessary to demonstrate isolation from sensitive surface water environments. Wherever there is a potential for surface water impact, the proponent should contact the MOEE Regional Surface Water staff.

When it has been demonstrated that the sewage effluent will not enter supply aquifers, the lot density of the proposed development may be dictated by factors such as the need for sewage system replacement areas (i.e., contingency area), and by the minimum distances between individual on-site beds and wells, as defined by Ontario Regulations 358 and 903.

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5.6 Step Three: Contaminant Attenuation Considerations

Where it cannot be demonstrated that the sewage effluent is hydrogeologically isolated from all existing or potential supply aquifers, a hydrogeologic study is required to assess the risk that the development's individual on-site systems will cause concentrations of nitrate-nitrogen in ground water to exceed 10 mg/L at the downgradient property boundary. As described below, there are various methods by which this detailed risk assessment can be done.

5.6.1 Monitoring-based Assessments

The Ministry recognizes that ground water, infiltrating precipitation and sewage effluent will not be completely mixed at the property boundary. It is also recognized that processes such as absorption, denitrification, filtration and biodegradation may attenuate contaminants as the effluent passes down through the unsaturated zone and moves into the saturated zone. Since these processes are extremely difficult to quantify with any accuracy, they are usually only considered as a safety factor. However, if the consultant can provide documentation to the satisfaction of MOEE regarding the presence and extent of these processes on-site, their impact on nitrate concentrations will be considered. As discussed below, there is a number of ways in which this can be done.

a) Existing Development

In some situations, there may be nearby on-site sewage system-based development in a similar hydrogeological environment. If this development has been in place for a lengthy period of time, information on existing ground water quality could be used to demonstrate the combined effect of all available attenuative processes. This empirical information may then be used to help predict the impact of the proposed development.

The onus is on the proponent and/or the consultant to demonstrate adequately that:

i) the existing and proposed developments are located in similar hydrogeological environments;

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ii) sewage effluent (quantity and quality) from the existing and proposed developments are comparable;

iii) monitoring produces results which accurately represent water quality conditions beneath the existing development. The consultant must provide a clear rationale for the number of times the site is sampled, the period of time over which the sampling has been undertaken (capturing seasonal variations), and the rationale for the way in which this information is used in the assessment.

In general, monitoring of ground water quality should be concentrated close to the existing individual on-site systems. Due to effluent plumes possibly forming discrete, elongated shapes, intensive monitoring may be required to ensure that monitoring wells located further from the individual on-site systems are measuring effluent concentrations within the effluent plume(s). Water supply wells are not meant to be used as monitoring wells.

Background chemistry may be taken from existing wells to augment testing that has the purposes of the purposes of been completed in a manner consistent with this section. This use of wells would only be applicable where the wells are shallow wells, since it is the quality of the ground water which receives sewage effluent that is under consideration. The consultant should justify selection and use of wells and demonstrate that the data are representative of the shallow ground water table which will receive the sewage effluent.

b) Phased Development

In situations where there is no existing development, it may be possible to develop lands considered in the planning document in phases, beginning with the upgradient portion. Information obtained from monitoring effluent discharged from individual on-site systems in the upgradient phase, and its impact on ground water, can then be used to determine the extent to which the downgradient portion of the site can be developed. Before approving such a phased development, the Ministry must be satisfied by the Ministry of Municipal Affairs (MMA) or the delegated planning

TECHNICAL GUIDELINE FOR INDIVIDUAL ON-SITE SEWAGE SYSTEMS (continued)

approval authority, that adequate planning controls are in place to regulate development of the downgradient portion of the site.

The consultant will indicate, with supporting hydrogeologic information, the appropriate method and duration of monitoring required to demonstrate the predicted impacts. Monitoring must continue until such time as the predicted impacts at the phased property boundary are substantiated. Should the monitoring results show otherwise, then adjustments to the later development phase(s) could be made.

This approach is no guarantee that similar (or greater) density would be permitted on the adjacent downgradient phase. In fact, it may show that less density would be more appropriate. One of the problems that arises here is how representative the monitoring will be if all of the lots in the first phase have not been built and occupied. For this approach to be completely acceptable, all lots would need to be built and occupied.

5.6.2 Predictive Assessment - Residential Development

The Ministry requires the following considerations and assumptions to be used in assessing the combined impact of individual on-site sewage systems at the boundary of residential developments:

a) **Contaminant Source**: In most cases total nitrogen (all species) converted to nitrate-nitrogen is considered as the critical contaminant. For the purposes of predicting the potential for ground water impacts, a nitrate loading of at least 40 grams/ lot/ day per residential dwelling unit shall normally be used[6].

b) **Contaminant Attenuation:**

i) In assessing contaminant attenuation, only dilution will be accepted

[6] This is based on expected actual flows of 1,000 L/day and a minimum value of 40 mg/L nitrate-nitrogen in the discharge from a Class 4 or Class 6 system (see O. Reg. 358) treating domestic/household sewage.

TECHNICAL GUIDELINE FOR INDIVIDUAL ON-SITE SEWAGE SYSTEMS (continued)

by the Ministry as a quantifiable attenuation mechanism for nitrate.

ii) Dilution models involve dilution with infiltrating precipitation. Mixing with ground water flowing through the site will normally not be allowed because it is usually not possible to control upgradient land uses. Flow through will not be considered where sensitive hydrogeological conditions exist. However, where upgradient lands have been fully developed for a considerable period of time, the quantity and quality of ground water flow available to dilute the effluent entering the receiving ground water may be considered.

iii) The amount of available moisture surplus should normally be obtained from Environment Canada. Where available, reliable, long-term, site specific information, obtained from detailed water balance and/or ground water studies, can be used.

For predictive assessment, this section is very crucial as it has a direct bearing on the density of development that can be reasonably expected. Given this, careful attention needs to be given to determining how much water actually gets into the ground at any given development location. Environment Canada Information provides a good starting point, but it must be recognized that this information may have limitations imposed by geographic differences over an area. The consultant must provide justification for and documentation in support of infiltration values used for the impact assessment. Environment Canada can provide a detailed water budget representative of specific areas.

iv) Estimates of the amount of this surplus which infiltrates into the ground must be based on site specific factors such as soils, topography, surface geology, and impermeable areas (including roof tops and paved areas).

This section is also crucial to the amount of density of development that can be expected. The type of soils on the site as well as topography and surface cover

TECHNICAL GUIDELINE FOR INDIVIDUAL ON-SITE SEWAGE SYSTEMS (continued)

have a direct relationship with the amount of water which will infiltrate.

Information on soil type, stratigraphy, saturation, particle size, structure, porosity and density are essential components. The depth of soil pits used in the analysis is crucial as the interest is in how much of the water can reach the tile bed to mix with the sewage effluent. Soil information below the bed is also essential in determining the impacts on receiving ground water.

Frequency of testpitting on the site should be governed by the complexity of soil types and geology across the site and complexity of topographical conditions across the site. If a site is fairly homogeneous the number of test pits may be less than for a site which is not homogeneous. Another crucial consideration is the potential changes to a site's soil cover that can occur from grading and regrading activities which are part of the site's development. The hydrogeologist must be prepared to take these into consideration, otherwise calculations of infiltration and, therefore, of ground water impact could be severely compromised. The consultant may consider recommending that areas of the proposed development be left relatively undisturbed to ensure that infiltration expectations will be met.

Storm water management facilities may also contribute to infiltration. However, they may also detract from infiltration by directing water away from the tile bed areas. These facilities should be considered as part of determination of available infiltration.

v) The volume of sewage effluent, if used as dilution water in mass balance calculations, should not exceed 1,000 L/day/lot.

vi) Mathematical (computer) models may be used to assess the impact potential. Although the selection of model software will be left to the proponent, the Ministry must be provided with information on the model's validation and how its limitations and assumptions affect the results. All model simulations must include appropriate sensitivity analyses.

It is the intent of MOEE to allow only those dilution models to be used which are

TECHNICAL GUIDELINE FOR INDIVIDUAL ON-SITE SEWAGE SYSTEMS (continued)

reasonable and can be defended on a site specific basis. Where the Ministry has concerns regarding the predicted impact, the Regional Director may consider designating the development under Notice 3/87.

5.6.3 Predictive Assessment - Industrial/Commercial Development

This guideline only applies to developments which have an average daily flow of less than 4,500 L/day/lot. Developments with larger flows will be assessed according to MOEE's Guideline B-7 (formerly Policy 15-08). In addition, the sewage assessed should consist of domestic wastes only. No industrial/ commercial cooling or process wastewater is to be considered.

The nitrate loading from industrial/commercial individual on-site systems can vary greatly depending on the type and intensity of use. Since specific uses for each lot or block are not known at the planning document review stage, it is necessary to determine how much nitrate can be discharged from each individual on-site system without exceeding the ODWO of 10 mg/L at the property boundary. The following procedure is then used to set maximum allowable effluent flows for each lot:

a) **Available Infiltration:**

i) The amount of available moisture surplus should normally be obtained from Environment Canada. Where available, reliable, long-term, site specific information, obtained from detailed water balance and/or ground water studies, can be used.

ii) Estimates of the amount of moisture surplus which infiltrates into the ground must be based on site specific factors such as soils, topography, surface geology, and impermeable areas (including roof tops and paved areas).

b) **Maximum Allowable Flow:**

The maximum allowable flow for each lot or block in the industrial/ commercial

TECHNICAL GUIDELINE FOR INDIVIDUAL ON-SITE SEWAGE SYSTEMS (continued)

development can be calculated by dividing the amount of available infiltration (from a)) by a factor of three[7].

c) **Maximum Number of Users:**

To determine the maximum number of users which can be supported by the calculated allowable flow, please refer to Appendices 9.3.1 and 9.3.2 of MOEE's "Manual of Policy, Procedures and Guidelines for On-Site Sewage Systems." Restrictions regarding the allowable number of users will normally be incorporated as recommendations in the consultant's assessment, and the recommendations shall be implemented by provisions in the development agreement between the proponent and the municipality.

5.7 Additional Research

The Ministry recognizes that the assumptions required for allowing a predicted level of 10 mg/L to be used as a boundary target criterion, for exempting lots of one hectare, or for using nitrate-nitrogen as the critical contaminant etc., may not be technically supported in every case. The Ministry recognizes that as research continues, information and technologies may become available which warrant minor or substantial revisions to this guideline.

6.0 IMPLEMENTATION

MOEE staff will implement this guideline through comments and advice supplied to municipalities, the public, and the approval Authority on planning documents circulated under the *Planning Act.*

For development applications (official plan amendments, plans of subdivision or condominium) involving more than five lots with individual on-site sewage systems, the approval Authority must ensure that an impact assessment has been completed in accordance with this Guideline which demonstrates that the impacts on ground and surface water of the proposal will be within acceptable limits. Shoreline development proposals

[7] This was derived by simplifying the equation (40 mg/L x Flow) / (Flow + Infiltration) = 10 mg/L - Background

will be reviewed on a case-by-case basis. The ground water impact assessment must be approved by MOEE prior to its recommendation that draft approval be granted for plans of subdivision and condominium, and prior to approval of most official plan amendments.

As part of MOEE's recommendation that draft approval be granted, MOEE will request a condition of final approval which specifies that the MOEE receive a copy of a fully-executed subdivision/ condominium agreement or other suitable development agreement between the municipality and the developer. The agreement will require that the recommendations of the impact assessment report as approved by MOEE (or its agents) be implemented.

For industrial or commercial development applications involving individual on-site systems, the approval Authority should ensure that a municipal by-law is enacted for the subject lands restricting the industrial/ commercial uses to "dry industrial/ commercial uses".

7.0 DEFINITIONS

Combined Impact: Refers to the blended impact of all the individual on-site systems on the development site. The impact of the system's effluent discharge on ground water is not assessed on a plume by plume basis.

Director: Either the Director under Part VIII of the *Environmental Protection Act* or the Regional Director of the MOEE.

Individual On-site Sewage System: An on-site Class 4 or Class 6 sewage system regulated by Ontario Regulation 358 under the *Environmental Protection Act.*

Supply Aquifers: For the purposes of this guideline, a supply aquifer is defined as ground water which is or which may be used to provide domestic water supply(ies). Designation of ground water for other than domestic consumption is at the Director's discretion (see Section 5.3).

TECHNICAL GUIDELINE FOR INDIVIDUAL ON-SITE SEWAGE SYSTEMS (continued)

Dry Industrial/Commercial Uses: Those uses in which only the disposal of the domestic waste of employees is permitted and treated. No industrial liquid wastes, wash or cooling water or process wastes are permitted.

Hydrogeologically Isolated: Those areas characterized by strong upward hydraulic gradients; massive, unfractured clay deposits at or near ground surface; or other thick impervious layers of materials over water-bearing formations.

8.0 REFERENCE DOCUMENTS

Other documents that should be used in conjunction with this Guideline include:

- "Comprehensive Set of Policy Statements", Province of Ontario;

  Policy Statement B7, "Planning for Sewage and Water Services", Ontario Ministry of Environment and Energy (MOEE);

  Policy Statements B8 through B11, "Growth and Settlement", Ontario Ministry of Municipal Affairs (MMA).

- "Implementation Guidelines to the Comprehensive Set of Policy Statements", Province of Ontario

  Implementation Guideline to Policy Statement B7, "Planning for Sewage and Water Services", Ontario Ministry of Environment and Energy (MOEE);

  Implementation Guideline to Policy Statements B8 through B11, "Growth and Settlement", Ontario Ministry of Municipal Affairs (MMA).

- "Technical Guideline For Water Supply Assessment For Private Wells: Water Supply Assessment", MOEE.

- "Manual of Policy, Procedures and Guidelines for On-site Sewage Systems", MOEE.

- "Class Environmental Assessment for Municipal Sewage and Water Projects", Municipal Engineers Association.
- "Class Environmental Assessment Document: Expansion or Upgrading of an Existing Sewage or Water System", Ecologistics Limited and MOEE.

4.5 RELATED ISSUES

Ground Water Recharge

The ability of natural soil to absorb and transmit precipitation to the water table is an important consideration in assessing the suitability of an area for subsurface sewage systems. For the purposes of this discussion the portion of infiltrating precipitation that reaches the ground water table will be considered ground water recharge. Areas with high ground water recharge capability have greater importance with respect to replenishing ground water aquifers. Areas of high ground water recharge are also areas susceptible to contamination from accidental spills or surface sources of contamination such as road salt, agricultural fertilizers or sewage effluent from subsurface sewage systems.

The impact assessment of subsurface sewage systems allows consideration of available ground water recharge for dilution purposes. This must, however, be weighed against the risk of contamination of ground water supply aquifers.

The methods for calculating ground water recharge may involve the use of a climatic water budget and applying it to the area proposed for development. An example of a typical water budget summary showing the average monthly water balance is provided in Table 1. Ground water recharge is not only dependent upon the amount of surplus water available from the water budget, but also upon site conditions including topography, slope, soil type and surface cover type such as cultivated lands, woodlands and impermeable cover. There have been different methods proposed for determining ground water recharge. One such method was proposed in 'Guidelines for the Preparation of a Rural Servicing Report for Development to be Serviced by On-Site Sewage System', MOEE (Draft, March 1989). Table 2, taken from this document, illustrates the variables which may be used in determining an appropriate infiltration factor. The

magnitude of the infiltration factor is obtained by adding the appropriate values for topography soil and cover type. The cumulative total of these factors is applied to the available surplus water to determine the ground water recharge for a given area. The infiltration factors shown on Table 2 are based on a hydrologic analysis that was designed for assessing peak runoff for storm water management purposes. This provides a worst case scenario with respect to runoff and is conservative in estimating the amount of ground water recharge.

Table 1: Example of Water Budget Summary

Month	*Mean Monthly Temperature °C*	*Mean Monthly Precipitation mm*	*Actual Evapotranspiration mm*	*Actual Water Balance mm*
January	-7.1	59.1	0	59
February	-6.6	50.6	0	51
March	-1.4	69.0	0	69
April	5.6	72.3	30	43
May	12.1	70.4	75	-5
June	17.5	64.2	101	-37
July	20.1	77.0	102	-25
August	19.1	74.9	86	-11
September	15.0	61.2	65	-4
October	8.8	59.5	40	19
November	3.0	69.7	11	59
December	-3.9	74.5	0	75
Yearly Total:		**802.4**	**510**	**292**

Notes:
1) Long-term meteorological data (1982 - 1980) from MOE Markham Station.
2) Water budget calculation based on Thornthwaite and Mather Method and 100 mm soil moisture storage.

Table 2: Infiltration Factors	
Description of Area/Development Site	**Value of Infiltration Factor**
TOPOGRAPHY	
■ Flat land, average slope not exceeding 0.6 m per km	0.30
■ Rolling land, average slope of 2.8 m to 3.8 m per km	0.20
■ Hilly land, average slope of 28 m to 47 m per km	0.10
SOIL	
■ Tight impervious clay	0.10
■ Medium combinations of clay and loam	0.20
■ Open sandy loam	0.4
COVER	
■ Cultivated lands	0.1
■ Woodland	0.2

Ground water recharge has also been determined in some areas on a watershed or subwatershed basis. This information is available in selected water resource studies completed by the former Water Resources Branch of the MOEE. A listing of these reports is provided in AppendixB.

Climatic conditions vary throughout Ontario and will, together with factors such as soil conditions and physical settings determine the amount of ground water recharge over a given area. Based upon experience typical ground water recharge rates that can be expected in Southern Ontario are outlined as follows:

Table 3: Typical Ground Water Recharge Rates		
Soil Texture	**Ground Water Recharge Rate**	
	(mm/yr)	*(L/Day/Hectare)*
■ coarse sand and gravel	250+	7000+
■ fine to medium sand	200 - 250	5600 - 7000
■ silty sand to sandy silt	150 - 200	4200 - 5600
■ silt	125 - 150	3500 - 4200
■ clayey silt	100 - 125	2800 - 3500
■ clay	less than 100	less than 2800

Significantly different ground water recharge rates from those noted above can be expected in some areas depending upon climatic conditions and physical setting. A site specific analysis would be able to take these factors into account.

Ground water recharge available for a particular property can be determined by using the above noted approaches or by more detailed analysis. The latter could involve computer modelling and/or on-site measurements using infiltrometers. It will be the consultant's responsibility to determine the method used to assess the available ground water recharge. Any assessment of ground water recharge will need to consider pre and post development conditions.

Baseflow to Streams, Wetlands

The ground water contribution to streams and natural wetlands is important in sustaining these features. The creation of relatively impervious surfaces such as roads and buildings may reduce the amount of shallow ground water available to sustain local streams and wetlands during certain times of the year. Regrading of an area and storm water management facilities may also contribute to a reduction of infiltration causing a loss of shallow ground water flow. The degree to which shallow ground water flow is altered is largely dependent upon the infiltration capabilities of an area and the nature of the proposed development. For example, areas underlain by fine grained silt and clay soils, having naturally low infiltration capabilities, will likely experience relatively little reduction in infiltration as a result of development compared to areas of more permeable soil which may become partially covered with impermeable surfaces.

The degree to which streams and wetlands may be affected by disruption of shallow ground water flow is also dependent upon the proximity of the proposed development and the degree to which there is a hydrogeological connection between the stream or wetland and the proposed

development. This connection should be determined either through existing information such as well records or by testing through subsurface investigations. Interpretations of shallow ground water movement will be useful in determining the potential for direct hydrogeological connection between a stream or wetland and a proposed development.

Existing Soil/Ground Water Contamination

A review of existing and past land uses in the vicinity of a proposed development may result in the identification of a potential source of contamination such as a landfills, fuel or chemical storage facilities, intensive agricultural uses or previous chemical spills. Phase I environmental audits and Phase II soil investigations should be completed where there is reason to suspect contamination of a property from previous or existing land uses. These investigations will need to identify the level of contaminants present and the need for remediation. Subsurface soils will need to meet specific criteria depending upon the proposed land use. For example, agricultural, residential and parkland uses have different criteria than lands used for commercial/ industrial activities. The proponent is referred to:

a) 'Guidelines for Decommissioning and Clean Up of Sites in Ontario', MOEE, May 1990; and
b) 'National Guidelines for Decommissioning Industrial Sites', CCME, March 1991.
c) Interim Guidelines for the Assessment and Management of Petroleum Contaminated Sites in Ontario, MOEE, August 1993.

The current MOEE recommended Site Decommissioning Procedures are illustrated in Figure4.

The above documents should be referred to for study requirements and specific clean up criteria. It should be noted that the above guidelines may be updated from time to time. The MOEE should therefore be contacted before starting investigations to ensure the most current requirements will be met.

In the case of an abandoned landfill near or on the property proposed for development, hydrogeological information will be required to determine the extent of contamination on the property or the risk of future contamination from an upgradient facility. In most cases, existing landfill sites require monitoring of ground water and surface water as part of their Certificate of Approval. When an old landfill or waste disposal site has been closed for some time, there may

be relatively little information available, particularly if it was a private waste disposal site. The type of investigation and the level of effort required will depend largely on individual circumstances on a site by site basis. Consultation with the MOEE is recommended to establish an appropriate work program.

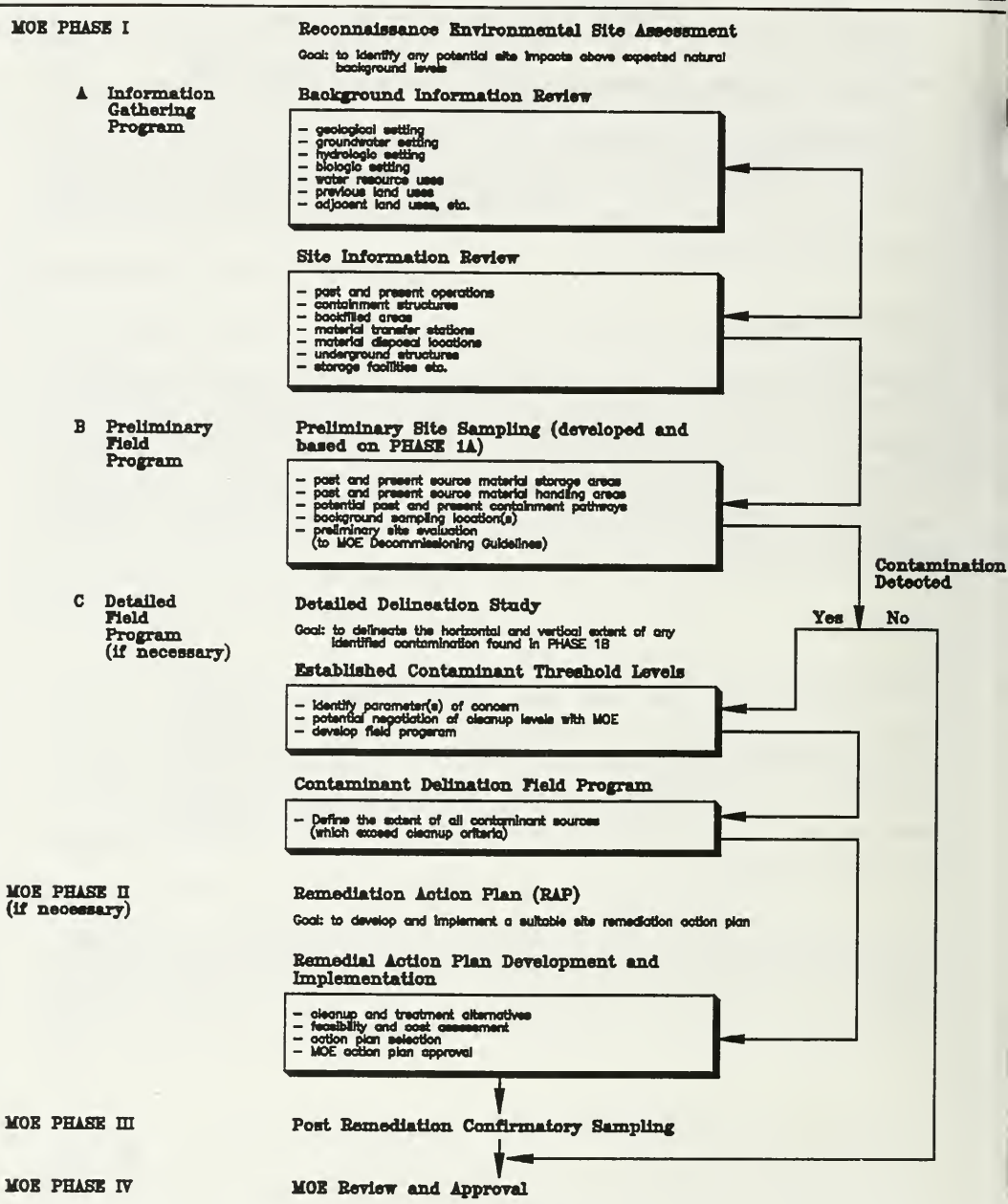
Aggregate Resources

Operations associated with existing pits and quarries in the vicinity of a development proposal may have an impact on the subject property. For example an aggregate pit or quarry may use ground water for their operations and could be operating with an existing Permit To Take Water. This should be taken into account when investigating water supply aquifers for the proposed development. Other non-hydrogeological issues such as noise and dust also fall under the mandate of the MOEE.

Agriculture

Agricultural land use may have had an impact upon the shallow ground water system through the use of agricultural chemicals. Information on past land use practices may be useful in explaining background ground water quality where it is evident that elevated levels of some nutrients such as nitrate nitrogen are found in the shallow ground water system. This is particularly important where it is being argued that nutrient concentrations will decline as a result of the change in land use.

Agricultural drainage practices may also have the potential to affect shallow wells. It is therefore important to know what drainage works exist or are planned in the vicinity of the development proposal.


MOE PHASE I
Reconnaissance Environmental Site Assessment
Goal: to identify any potential site impacts above expected natural background levels
A Information Gathering Program
Background Information Review
– geological setting
– groundwater setting
– hydrologic setting
– biologic setting
– water resource uses
– previous land uses
– adjacent land uses, etc.
Site Information Review
– past and present operations
– containment structures
– backfilled areas
– material transfer stations
– material disposal locations
– underground structures
– storage facilities etc.
B Preliminary Field Program
Preliminary Site Sampling (developed and based on PHASE 1A)
– past and present source material storage areas
– past and present source material handling areas
– potential past and present containment pathways
– background sampling location(s)
– preliminary site evaluation (to MOE Decommissioning Guidelines)
Contamination Detected
Yes
No
C Detailed Field Program (if necessary)
Detailed Delineation Study
Goal: to delineate the horizontal and vertical extent of any identified contamination found in PHASE 1B
Established Contaminant Threshold Levels
– identify parameter(s) of concern
– potential negotiation of cleanup levels with MOE
– develop field program
Contaminant Delination Field Program
– Define the extent of all contaminant sources (which exceed cleanup criteria)
MOE PHASE II (if necessary)
Remediation Action Plan (RAP)
Goal: to develop and implement a suitable site remediation action plan
Remedial Action Plan Development and Implementation
– cleanup and treatment alternatives
– feasibility and cost assessment
– action plan selection
– MOE action plan approval
MOE PHASE III
Post Remediation Confirmatory Sampling
MOE PHASE IV
MOE Review and Approval

Ontario Ministry of the Environment

RECOMMENDED SITE DECOMMISSIONING PROCEDURE

Figure 4

GLL 93-264 APRIL 1994

5 GENERIC CASE STUDIES

CHAPTER 5

GENERIC CASE STUDIES

There are significantly different hydrogeologic environments encountered throughout Ontario. These differences must be recognized and study approaches should take these into consideration. The following examples, representing the major types of conditions or physical settings encountered in Ontario, are used to conceptually illustrate approaches to completing hydrogeological assessments in support of development proposals. Variations from the following examples will most likely be encountered on a case by case basis and will require study approaches that are tailored to each situation. The proponent's consultant should consult with the Regional MOEE office to assist in identifying hydrogeologic issues specific to the development application. It is the responsibility of the proponent's consultant to determine the site-specific information requirements and scope of investigations. This document is only to be used as a general guide and should not be considered as a replacement for consultation with the MOEE office.

5.1 UNCONFINED AQUIFER

Unconfined aquifers are commonly encountered throughout Ontario. These areas generally consist of permeable soil and/or fractured bedrock which are in direct hydraulic connection with the ground surface as illustrated in Figure 5. Unconfined aquifers will respond to changes in the quantity or quality of infiltrating precipitation. These aquifers may be vulnerable to sources of contamination such as sewage effluent from subsurface sewage disposal systems and can be considered as hydrogeologically sensitive.

Water Supply Assessment

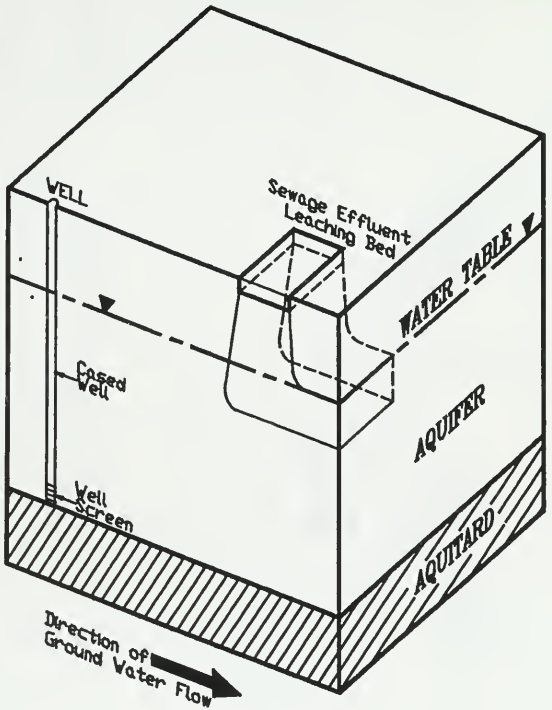
Development proposals, located within areas of unconfined aquifers that are considered to represent a hydrogeologically sensitive environment, will not be recommended for approval by the MOEE unless it can be demonstrated that the water supply aquifer will not be adversely affected by subsurface sewage systems.

The water supply assessment should identify the aquifer characteristics including thickness, lateral continuity, and ability to yield adequate quantity and quality of water without resulting in adverse interference effects with proposed on-site or nearby wells. The number of test wells required will depend upon the hydrogeological complexity of the area, the size of the property and the availability of suitable existing wells to test. Test drilling for water supply should also consider drilling to the greatest practical depth to confirm whether alternate water supply aquifers are available. Test wells should fully penetrate the unconfined aquifer. Pumping tests should be completed in accordance with MOEE requirements appropriate to the situation (i.e., individual private wells or communal/ municipal wells). A typical test well and observation well arrangement is shown on Figure 6.

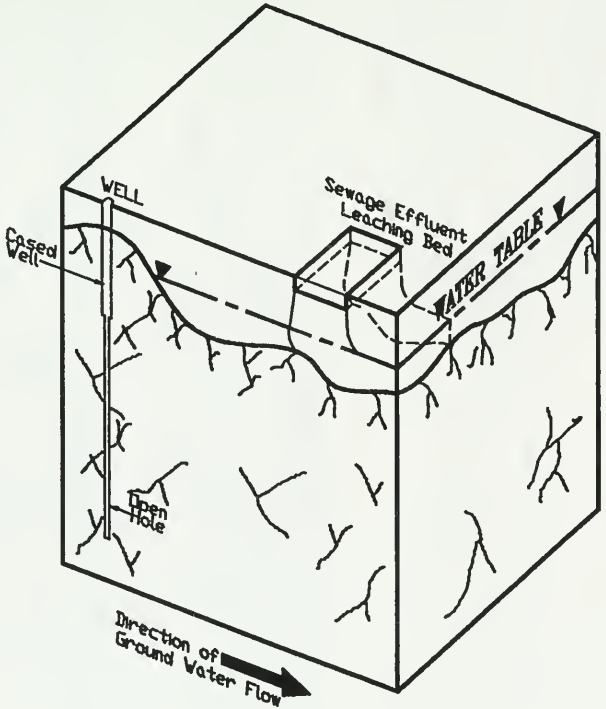
Care should be taken during pumping tests to ensure that discharge water is not recharged to the aquifer in the vicinity of the test well. In an unconfined aquifer the water supply should be sufficiently isolated or separated from subsurface sewage disposal systems to ensure that the water supplies will not be adversely affected. A clear understanding of the shallow ground water flow system will be an important requirement of this assessment. The 'cone of influence' from the water supply wells should be sufficiently defined to determine appropriate separation distances from other wells and subsurface sewage disposal systems. Ground water quality analysis will be required from on-site test wells and should be supported, where possible, by water quality results in nearby existing wells, preferably wells completed into the same aquifer.

The existing land uses, as well as known applications for land use changes within the potential cone of influence of the water supply wells should be documented. This is particularly important where potential sources of contamination may be introduced through other proposed land use changes. In the case of communal/ municipal water supply wells, it may be necessary for the municipality to implement land use controls within a certain distance of the wells in order to protect the ground water supply from potential sources of contamination.

UNCONFINED AQUIFER



SHALLOW SOIL OVER
FRACTURED BEDROCK



HYDROGEOLOGICALLY SENSITIVE ENVIRONMENTS

Figure 5

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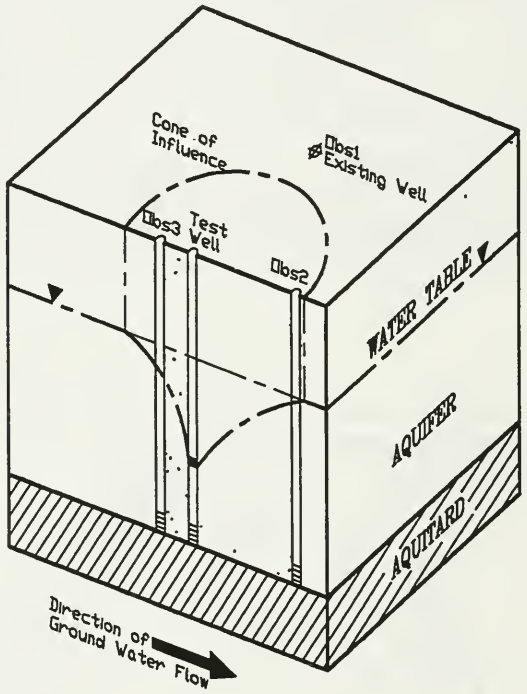

UNCONFINED AQUIFER
WATER SUPPLY ASSESSMENT

Figure 6

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Sewage System Impact Assessment

Subsurface sewage systems are designed to discharge contaminants to the subsurface. The risk to the underlying ground water resource, in particular, the water supply aquifer(s) needs to be determined. In an unconfined aquifer, there is often a short distance between the subsurface leaching beds and the aquifer (as illustrated in Figure 7). This may result in a potentially high risk of adverse impacts to the shallow aquifer.

A proponent will need to demonstrate that the proposed development will not adversely affect the water supply aquifer. This will require either a) establishing sufficient isolation of the supply aquifer from the subsurface sewage system (Step 2), or b) determine the level of impact anticipated on the supply aquifer through a monitor based assessment or a predictive assessment (Step 3).

Predictive assessments may involve a water budget or mass balance approach. The major components of a water budget approach, as illustrated in Figure 7 include the following:

a) Infiltration on the property (Qi)
b) Sewage effluent from subsurface sewage systems (Qe)
c) Insitu or background ground water (Qb)
d) Through flow of ground water (Q1 and Q2)

The quantity as well as the quality of the above components will need to be considered in the impact assessment through a mass balance equation.

Ground water through flow or underflow of the property should not normally be factored into the impact assessment unless the existing and possible future land uses of upgradient areas can be taken into account. This is generally not practical as future land uses could be difficult to control. Should upgradient areas be fully developed and the level of ground water impact be clearly established, then a portion of the ground water underflow may be available assuming the level of impact from existing development does not exceed acceptable levels.

The insitu ground water within the aquifer provides background ground water quality conditions (Cb). The extent to which existing ground water quality has been affected by past land use such as agriculture will determine the extent to which further impacts may be allowed. The

proponent's consultant may provide arguments to demonstrate that the level of existing impacts will diminish with a change in land. This will be considered on a case by case basis and will be evaluated based on the supporting information provided. If current ground water quality exceeds acceptable limits and it cannot be sufficiently demonstrated that the level of impact will be reduced with the change in land use, the MOEE will likely not recommend approval of the development proposal where on-site and adjacent ground water supplies will be at risk. The volume of the insitu ground water will ultimately be replaced by the infiltrating precipitation and therefore is not included in the mass balance equation.

The remaining critical factors are the sewage effluent (Q_eC_e) and the infiltration (Q_iC_i). These factors can be determined and the resultant concentration (C_T) can be calculated to determine an acceptable level of development which will not (theoretically) exceed the allowable level of contaminants.

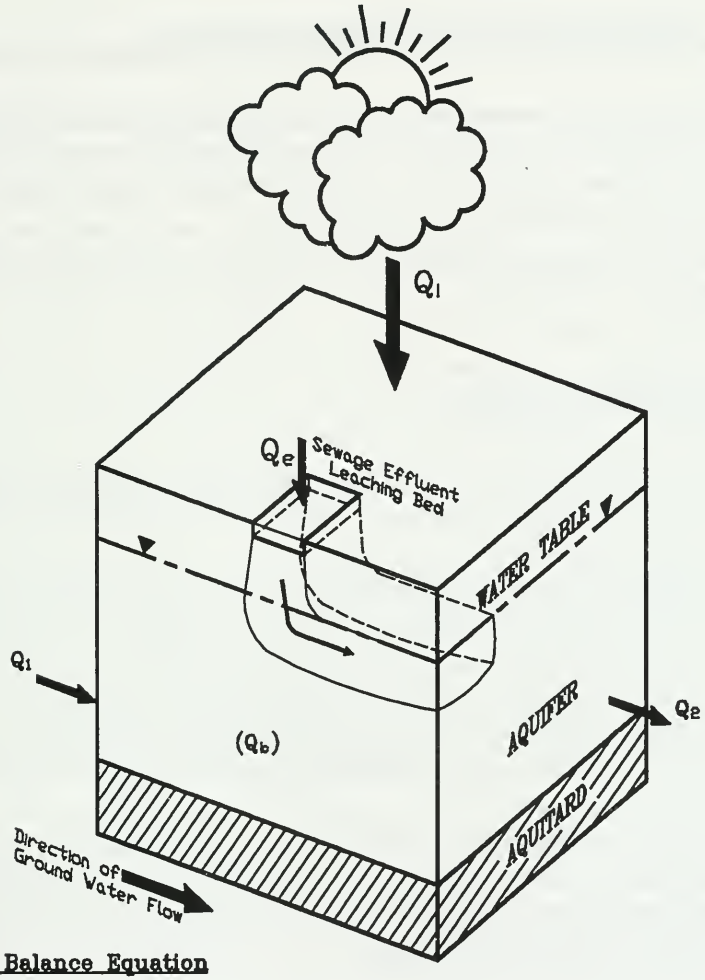
The above mass balance or water budget approach is a generalized approach and relies upon two basic assumptions:

a) complete mixing in the ground water system; and

b) no attenuating processes other than dilution are assumed to occur.

Neither of the above conditions are expected to be totally satisfied in a real situation. The consequences of this tend to offset one another as the second assumption is conservative and the other is not. Care must be taken when applying this approach to impact assessment in unconfined aquifers due to potentially high risk of impacts on the aquifer. The anticipated movement of ground water plumes must be carefully evaluated to ensure protection of the water supply aquifer. The selection of well locations must consider the siting of sewage systems. Other factors which could tend to lessen the risk to the water supply aquifer are a large distance from ground surface to the water table (potentially increasing attenuation) and a large aquifer thickness. These provide increased separation between the supply wells and the subsurface sewage system.

Large communal/municipal subsurface sewage systems may require a more in-depth analysis of the predicted impacts and could involve computer modelling of contaminant movement in the subsurface with predictions of contaminant plume migration. The level of study required should



Mass Balance Equation

$Q_T C_T = Q_e C_e + Q_I C_I + (Q_b C_b)$

where Q=volume and C=concentration of Critical Contaminant (NO_3-N)

Q_T = Total Volume (Q_e+Q_I)
Q_e = Sewage Effluent Volume
Q_I = Infiltration Volume

C_T = Concentration of total volume
C_e = Concentration of effluent
C_I = Concentration of Infiltration

Q_b = Aquifer volume (of water)
Q_1 = Ground Water Inflow to site
Q_2 = Ground Water Outflow from site

C_b = Concentration in aquifer (background concentration)

UNCONFINED AQUIFER
IMPACT ASSESSMENT
SUBSURFACE SEWAGE SYSTEM

Figure 7

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reflect the sensitivity of the environment and the potential risk to ground water supplies. For example, a proposed development directly upgradient of a communal or municipal ground water supply in an unconfined aquifer could be considered a high risk and may require a highly detailed analysis of predicted impacts, particularly where a communal subsurface sewage system was proposed. The MOEE should be consulted on a case by case basis for guidance in the level of study required.

5.2 CONFINED AQUIFER

Confined aquifers are commonly found throughout Ontario and can be defined as 'an aquifer that is confined between two aquitards' (Freeze and Cherry 1979). Aquitards are 'less permeable beds in a stratigraphic sequence ..... their permeability is not sufficient to allow the completion of production wells within them' (Freeze and Cherry 1979). The lower hydraulic conductivity of aquitards tends to impede the movement of ground water through them compared to the movement in the confined aquifer. Aquitards overlying an aquifer therefore provide a measure of protection to the confined aquifer from potential sources of contamination introduced at ground surface. The degree of protection offered to the underlying aquifer is dependent upon the nature, composition, thickness, lateral extent and uniformity of the confining layer. It should be noted that fine grained soils generally provide a relatively high degree of protection to underlying aquifers. However, the structure of fine grained soils, and notable fracturing of the upper few metres through natural weathering processes could significantly compromise the integrity of a confining layer. Studies at the University of Waterloo have demonstrated significant increase in soil permeability as a result of fractured subsoils.

Water Supply Assessment

The assessment of a confined aquifer for water supply is illustrated conceptually in Figure 8. The water supply assessment should identify the aquifer characteristics including its thickness, lateral continuity and ability to yield adequate quantity and quality of water without resulting in aquifer 'mining' and in adverse interference affects with proposed on-site or nearby wells. The nature and extent of the confining layer should also be established to evaluate the potential risk of contamination.

The number of test wells required depends upon the hydrogeological complexity of the area, the

size of the property and the availability of suitable existing wells to test. Pumping tests should be completed in accordance with MOEE requirements appropriate to the situation (i.e., individual private wells or communal/ municipal wells).

In a confined aquifer setting, pumping tests should include observation wells to measure the response in the aquifer to pumping the well in addition to possible responses in the shallow water table. This would allow calculation of the 'cone of influence' and determination of the potential for leakage through the confining layer. Provided the confining layer adequately isolates the aquifer from the surface, the placement of wells with respect to subsurface sewage systems will not be as critical as with unconfined aquifers. The 'cone of influence' from the water supply well(s) should be sufficiently defined to determine appropriate separation distances from other wells and subsurface sewage disposal systems.

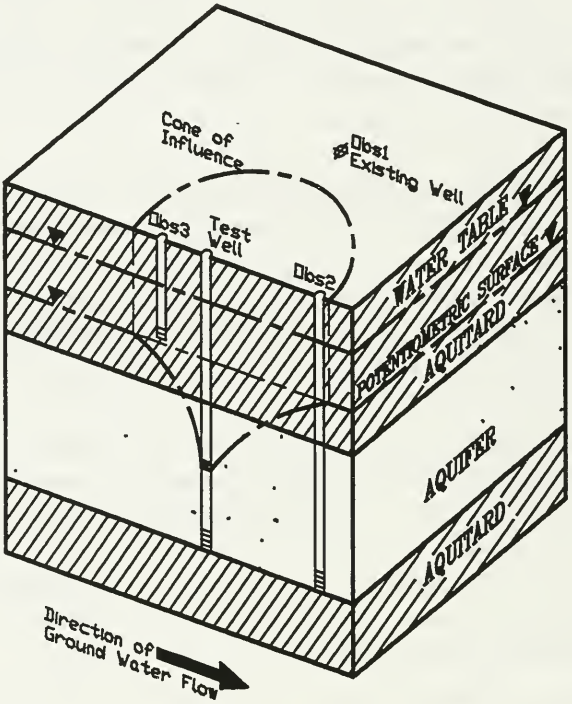
Ground water quality analysis will be required from on-site test wells and should be supported, where possible, by water quality results in nearby existing wells completed into the same aquifer.

Test drilling for a water supply should also consider drilling to the greatest practical depth to confirm whether alternate water supply aquifers are available. Test wells should, at a minimum, fully penetrate the confined aquifer intended as the water supply aquifer.

Confined aquifers are less susceptible to contamination than unconfined aquifers. The extent and continuity of the confining layer will determine the level of protection the confined aquifer may have from surface sources of contamination. A general description of previous and existing land use on the property and adjacent areas should be provided. This will be of value when assessing existing ground water quality. For example, the existence of a large feed lot operation directly overlying a confined aquifer which shows no evidence of impact from the feed lot may support conclusions regarding the integrity of the confining layer.

Sewage System Impact Assessment

The impact assessment for subsurface sewage systems in a confined aquifer situation is similar to that described earlier for an unconfined aquifer. The presence of a confining layer or aquitard will inhibit downward migration of sewage effluent as illustrated conceptually in Figure 9. The degree of isolation provided by the confining layer may, in some cases, provide sufficient protection to the water supply aquifer.



CONFINED AQUIFER
WATER SUPPLY ASSESSMENT

Figure 8

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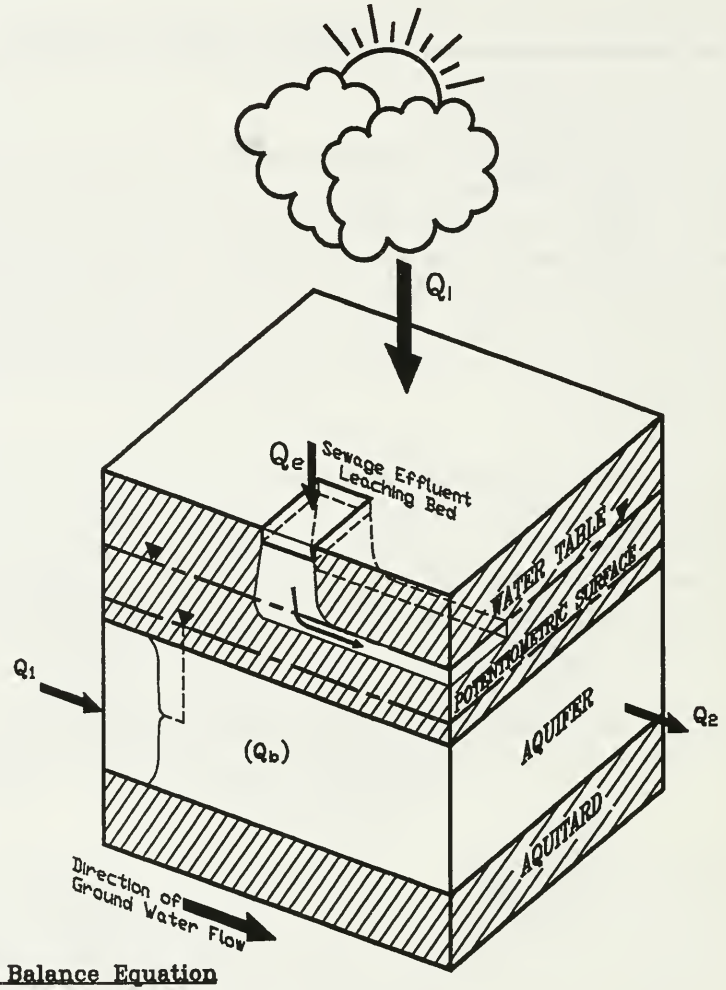
The proponent will need to demonstrate that the proposed development will not adversely affect the water supply aquifer. A three step evaluation procedure should be followed for individual on-site systems. Where development proposals involve lots that average less than 1.0 ha in size, the proponent will need to establish either a) sufficient isolation of the supply aquifer from the subsurface sewage system (Step 2) or b) determine the level of impact anticipated on the supply aquifer through a predictive or monitoring based assessment (Step 3). Where individual lots are greater than 1.0 ha on average, it will be necessary to demonstrate that the site is not hydrogeologically sensitive.

The degree of isolation of the water supply aquifer can only be demonstrated with a thorough understanding of the subsurface stratigraphy beneath a property and adjacent areas. This will involve subsurface investigations utilizing soil test pits, boreholes and test wells as well as existing information from adjacent areas. The scope and extent of investigations will be determined by the complexity of the subsurface conditions, the size of the property and the suitability of existing data.

A predictive assessment of impacts may include a mass balance or water budget approach similar to that described for an unconfined aquifer. This type of assessment is shown conceptually on Figure 9.

A fine grained silt and clay confining layer will tend to inhibit downward ground water movement, however, it will also limit the amount of infiltration available for purposes of diluting the sewage effluent. This will have the effect of requiring a larger area (i.e., larger lot) to meet the acceptable dilution requirements. Depending upon the degree of isolation of the underlying confined water supply aquifer, the determining factor for lot size may be the requirements for tile bed area, reserve bed area and setbacks from wells, structures and surface water bodies, and setbacks imposed by local land use by-laws.

A monitoring based impact assessment may also be used to determine the expected level of impact from individual on-site sewage systems. This would involve the monitoring of a similar development which is located nearby in a similar hydrogeological setting. The proponent would need to demonstrate that these settings are similar and that the impacts from the existing developments are directly comparable to the proposed development. This may involve intensive monitoring in close proximity to existing individual on-site sewage systems.



Mass Balance Equation

$Q_T C_T = Q_e C_e + Q_I C_I + (Q_b C_b)$

where Q=volume and C=concentration of Critical Contaminant (NO_3-N)

Q_T = Total Volume (Q_e+Q_I)	C_T = Concentration of total volume
Q_e = Sewage Effluent Volume	C_e = Concentration of effluent
Q_I = Infiltration Volume	C_I = Concentration of Infiltration
Q_b = Aquifer volume (of water)	C_b = Concentration in aquifer (background concentration)
Q_1 = Ground Water Inflow to site	
Q_2 = Ground Water Outflow from site	

CONFINED AQUIFER IMPACT ASSESSMENT SUBSURFACE SEWAGE SYSTEM

Figure 9

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Large communal/municipal subsurface sewage systems may require a more detailed analysis of the predicted impacts and could involve computer modelling of contaminant movement in the subsurface with predictions of contaminant plume migration. The level of study should reflect the sensitivity of the environment and the potential risk to ground water supplies. The impacts of large subsurface communal/ municipal systems are required to meet the Reasonable Use Policy.

5.3 MULTIPLE AQUIFER SYSTEM

It is possible to encounter areas underlain by more than one aquifer. Hydrogeological assessments should define the relationships of these aquifers and their existing and potential use. It will be necessary to provide recommendations for the use of a preferred aquifer(s). The major factors to consider in recommending a preferred aquifer include:

a) sustainable yield;
b) ground water quality;
c) susceptibility to contamination; and
d) ground water interference potential.

Water Supply Assessment

The ground water supply assessment involving a development proposal, where a multiple aquifer system exists, would include the basic elements of studies involving confined and/or unconfined aquifers. Due to the possibility of using more than one aquifer, these studies may involve additional testing to confirm the ground water availability and suitability from the different aquifers. Potential for ground water interference between aquifers may also need to be established. The components of a water supply investigation are illustrated conceptually on Figure10. The number of test wells, observation wells and pumping tests completed depends upon the hydrogeological complexity of the area, the size of the proposed development and the availability of suitable existing wells for testing. Pumping tests should be completed in accordance with the MOEE requirements appropriate to the situation (i.e., individual private wells or communal/ municipal wells).

Sewage System Impact Assessment

The impact assessment of development proposals in areas of multiple aquifers needs to demonstrate that ground water supplies would not be adversely affected by the development. For individual on-site sewage systems this will require either a) establishing sufficient isolation of the supply aquifer from the subsurface sewage system (Step 2), or b) determine the level of impact anticipated on the supply aquifer through a monitoring based assessment or a predictive assessment (Step 3).

The basic elements of a predictive assessment using a mass balance or water budget approach are illustrated in Figure 11. The example shown illustrates an unconfined aquifer at surface and a confined aquifer at depth. In this situation, it would appear that use of the confined aquifer as the preferred water supply source would minimize the risk of contamination from subsurface sewage systems. The existing or potential use of the upper aquifer must also be considered in assessing potential impacts. It is generally assumed for purposes of an impact assessment that use of an aquifer will ultimately be for domestic consumption unless it can be demonstrated that it is not reasonable for the aquifer to be used for this purpose. Examples of this could include aquifers that have naturally poor water quality unsuitable for domestic use or areas where aquifers are not likely to be used for domestic consumption due to land use or physical restrictions (i.e., fully serviced urban areas not relying on ground water, flood plains or wetland areas). Surface water quality impacts may need to be considered where there is a sensitive surface water body receiver nearby.

Impact assessments for large communal/municipal subsurface sewage systems may require more in-depth analysis of predicted impacts as described for other situations above. The level of detail and approach taken depends upon the hydrogeological sensitivity of the site and the risk of adversely impacting ground water supplies. The Reasonable Use Policy will apply to large communal/ municipal subsurface sewage systems.

5.4 SHALLOW SOIL OVER FRACTURED BEDROCK

Large portions of Ontario are underlain by shallow soil over fractured bedrock and are considered hydrogeologically sensitive. This includes large portions of Northern Ontario and Eastern Ontario, sections of the Niagara Escarpment, areas in the vicinity of Guelph, Puslinch Township

and isolated areas along the Lake Huron shoreline and the north shore of Lake Erie. These areas can be grouped into two basic types of environments:

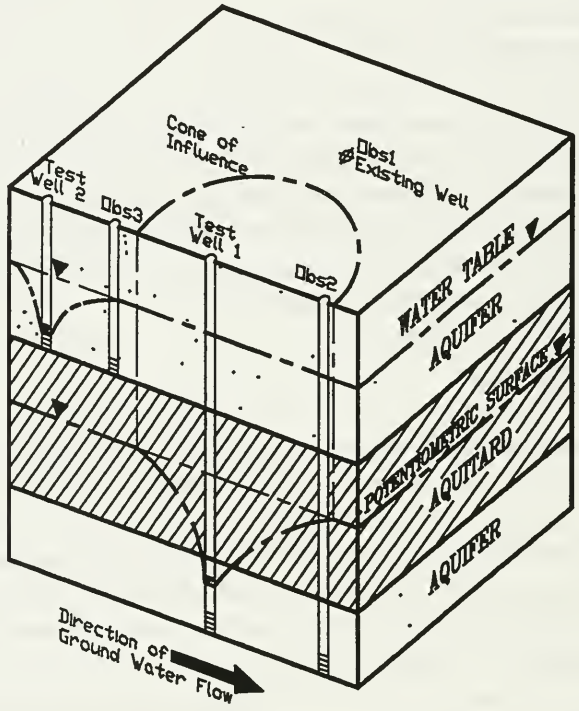
a) areas of layered sedimentary rocks (i.e., limestones, shales, sandstones); and
b) Precambrian rocks of the Canadian Shield (i.e., igneous and/or metamorphic rocks).

Both of these settings are hydrogeologically sensitive due to the potentially rapid movement of ground water through fractures and fissures in the rock. The layered sedimentary rocks tend to be more uniform and predictable in the subsurface compared to rocks of the Canadian Shield which tend to have more complex structures.

An example of layered sedimentary aquifer is the Guelph-Lockport and Guelph-Amabel aquifer. This is a major regional bedrock aquifer which is capable of high yields in some areas and provides a significant portion of the water supplies for the City of Guelph. This layered sedimentary bedrock aquifer is exposed along the brow of the Niagara Escarpment and areas into the west. Bedrock of the Canadian Shield is a less predictable aquifer but can, in many areas, provide sufficient water supplies for individual private wells.

Water Supply Assessment

The requirements for water supply assessments in areas of shallow soil over fractured bedrock will be similar to those for other physical settings. Since these areas are generally considered to be hydrogeologically sensitive and less predictable, it will be necessary to ensure adequate separation or isolation of the water supply aquifer from subsurface sewage disposal systems to meet the conditions of Step 2 of the Sewage System Technical Guideline. Water supply wells should therefore be completed to sufficient depth to provide an optimum separation or isolation of the water bearing zone(s) from the surface. The depth of drilling should be determined on a site specific basis. The components of a water supply investigation in an area of shallow soil over bedrock are illustrated in Figure 12.



MULTIPLE AQUIFERS
WATER SUPPLY ASSESSMENT

Figure 10

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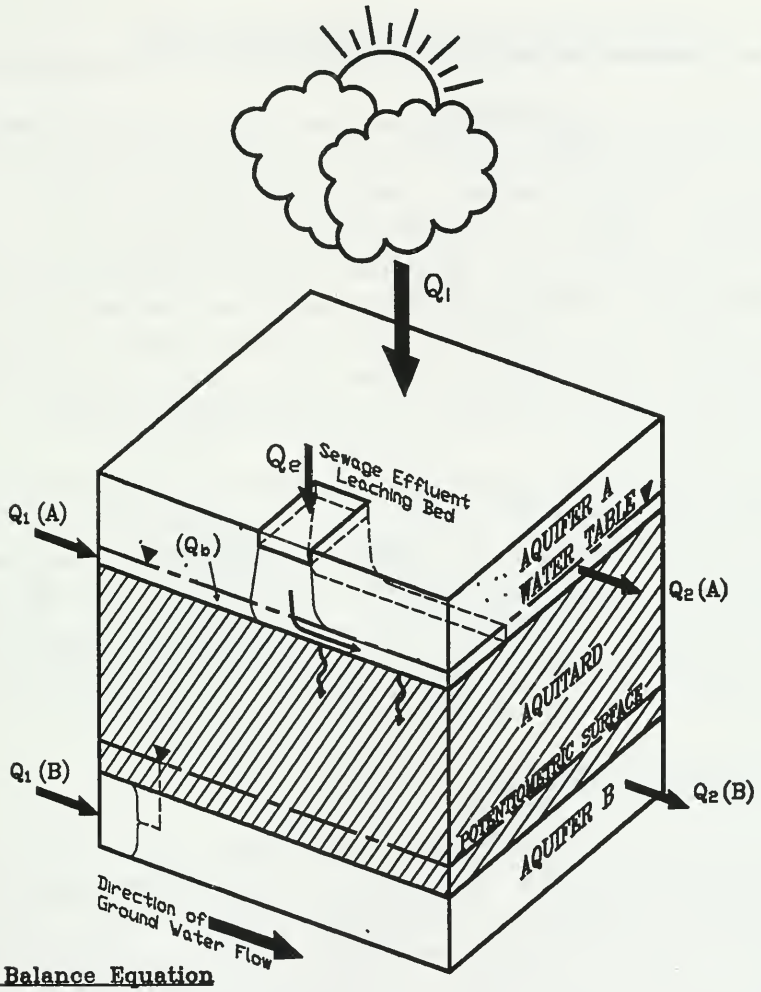

Mass Balance Equation

$Q_T C_T = Q_e C_e + Q_I C_I + (Q_b C_b)$

where Q=volume and C=concentration of Critical Contaminant (NO_3–N)

Q_T = Total Volume ($Q_e + Q_I$)
Q_e = Sewage Effluent Volume
Q_I = Infiltration Volume

C_T = Concentration of total volume
C_e = Concentration of effluent
C_I = Concentration of Infiltration

Q_b = Aquifer volume (of water)
Q_1 = Ground Water Inflow to site
Q_2 = Ground Water Outflow from site

C_b = Concentration in aquifer (background concentration)

MULTIPLE AQUIFERS IMPACT ASSESSMENT SUBSURFACE SEWAGE SYSTEM

Figure 11

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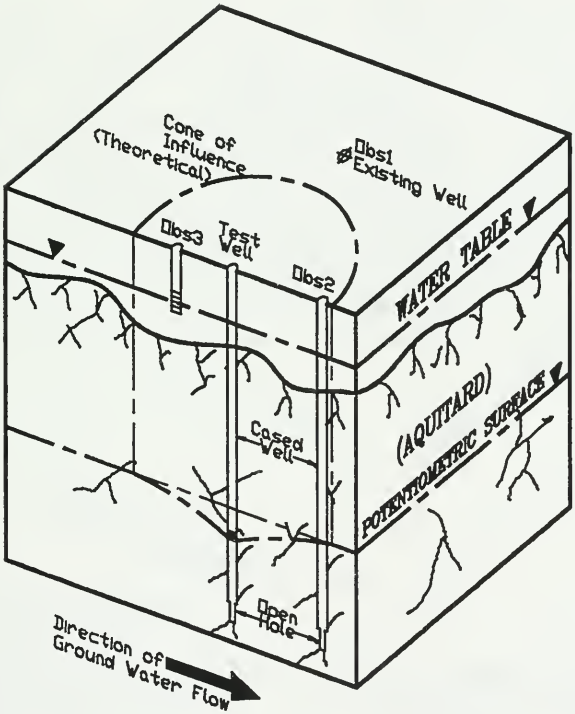
The methods for assessing ground water supply are similar to those used in other physical settings. A greater degree of uncertainty may, however, exist when predicting impacts such as the 'cone of influence' of water supply wells in complex bedrock environments. The use of safety factors or conservative assumptions may be warranted where there is a degree of uncertainly regarding the continuity of subsurface conditions. This could also be addressed by an increased number of test wells. The 'cone of influence' from a water supply well in fractured bedrock is likely to be asymmetrical where there is a dominant direction in the fracture pattern of the bedrock. An understanding of the bedrock structure would be useful in determining the placement of test wells and observation wells for the water supply investigation.

Communal/municipal wells located in an area of shallow soil over bedrock should be investigated in accordance with MOEE requirements for wells that require Permits To Take Water. The number of test wells and observation wells should be determined on a site specific basis depending on the sensitivity and complexity of the hydrogeologic setting and the area of proposed development. Discharge water from pumping tests should be directed a sufficient distance away from the test wells to avoid the possibility of recharging the aquifer with the discharge water.

Sewage System Impact Assessment

The impact assessment for subsurface sewage systems in areas of shallow soil over bedrock is required to demonstrate that there will be no adverse impacts on the water supply aquifer(s) nor impairment of use of these aquifers. For individual on-site subsurface sewage systems it will be necessary to a) establish that there is sufficient isolation of the water supply aquifer from the subsurface sewage system (Step 2), or b) determine the level of impact anticipated on the supply aquifer through a monitoring based assessment or a predictive assessment (Step 3).

Isolation of the water supply aquifer from the surface may be demonstrated through investigations related to the water supply assessment. In areas of complex bedrock, it may also be advisable to assess the potential impact on the shallow ground water system through a predictive assessment and/or a monitoring based assessment. These assessments may provide supporting information for determining an appropriate lot size. It should be noted, however, that predictive assessments as illustrated in Figure 13, are applicable only to the shallow soil and not the underlying fractured bedrock. There is relatively little dilution potential in most fractured bedrock due to the restrictive nature of ground water flow through discrete fractures. Locally



SHALLOW SOIL OVER
FRACTURED BEDROCK
WATER SUPPLY ASSESSMENT

Figure 12

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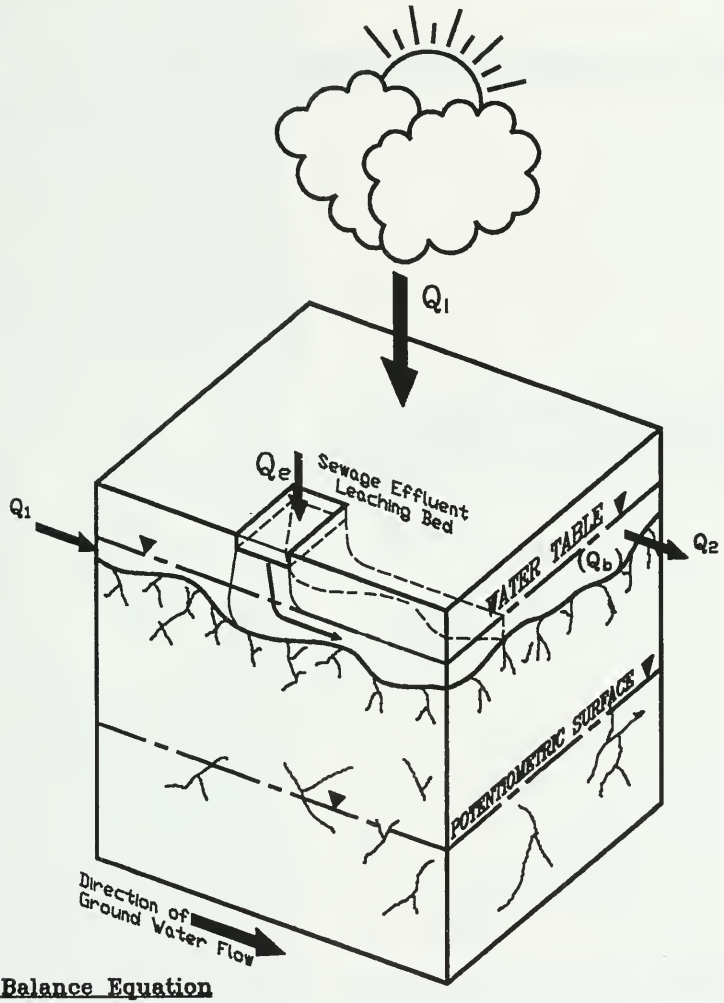
bedrock may, however, have a porous structure such as in portions of the Guelph Amabel Formation which contains very porous reefal structures surrounded by layered sedimentary rock.

Where the water table is within the bedrock, as shown on Figure 14, no significant mixing of recharge and effluent will occur within the overburden. Ground water supplies obtained from fractures connected to surface and located near subsurface sewage systems are at a significant risk of contamination.

Large communal/municipal subsurface sewage systems will require more in depth analysis of potential impacts and could involve computer modelling of contaminant movement in the subsurface with predictions of contaminant plume migration. The level of study will be determined by the sensitivity of the environment to contamination and the potential risk to ground water supplies. Where there is potential for relatively rapid ground water movement through fractures in the shallow bedrock, the risk to surface water bodies may also need to be evaluated. This could include a mass balance assessment of impacts based upon the shallow soil conditions on the property. Large subsurface sewage systems are required to meet the Reasonable Use Policy for ground water impacts at the downgradient property boundary. Surface water quality criteria may also apply in areas of sensitive surface water bodies.



Mass Balance Equation

$Q_T C_T = Q_e C_e + Q_I C_I + (Q_b C_b)$

where Q=volume and C=concentration of Critical Contaminant (NO_3-N)

Q_T = Total Volume (Q_e+Q_I)
Q_e = Sewage Effluent Volume
Q_I = Infiltration Volume

C_T = Concentration of total volume
C_e = Concentration of effluent
C_I = Concentration of Infiltration

Q_b = Aquifer volume (of water)
Q_1 = Ground Water Inflow to site
Q_2 = Ground Water Outflow from site

C_b = Concentration in aquifer (background concentration)

SHALLOW SOIL OVER FRACTURED BEDROCK SUBSURFACE SEWAGE SYSTEM (1)

Figure 13

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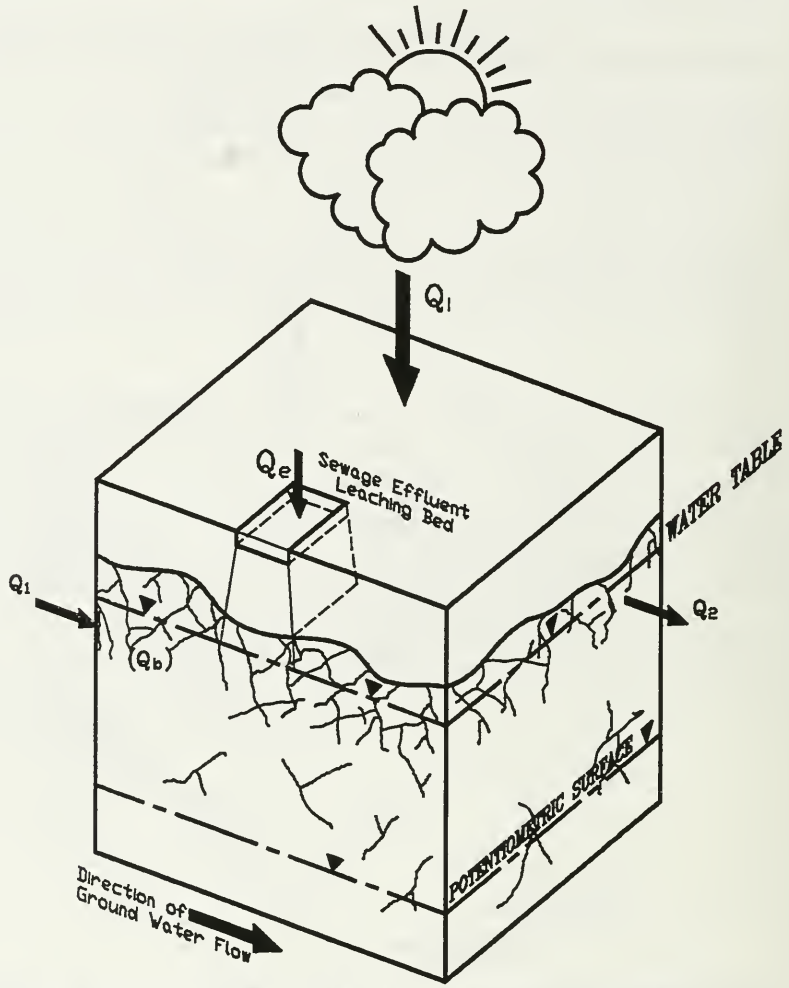

Mass Balance Equation (Does Not Apply to Fractured Bedrock)

$Q_T C_T = Q_e C_e + Q_I C_I + (Q_b C_b)$

where Q=volume and C=concentration of Critical Contaminant (NO_3-N)

Q_T = Total Volume (Q_e+Q_I)	C_T = Concentration of total volume
Q_e = Sewage Effluent Volume	C_e = Concentration of effluent
Q_I = Infiltration Volume	C_I = Concentration of Infiltration
Q_b = Aquifer volume (of water)	C_b = Concentration in aquifer (background concentration)
Q_1 = Ground Water Inflow to site	
Q_2 = Ground Water Outflow from site	

SHALLOW SOIL OVER
FRACTURED BEDROCK
SUBSURFACE SEWAGE SYSTEM (2)

Figure 14

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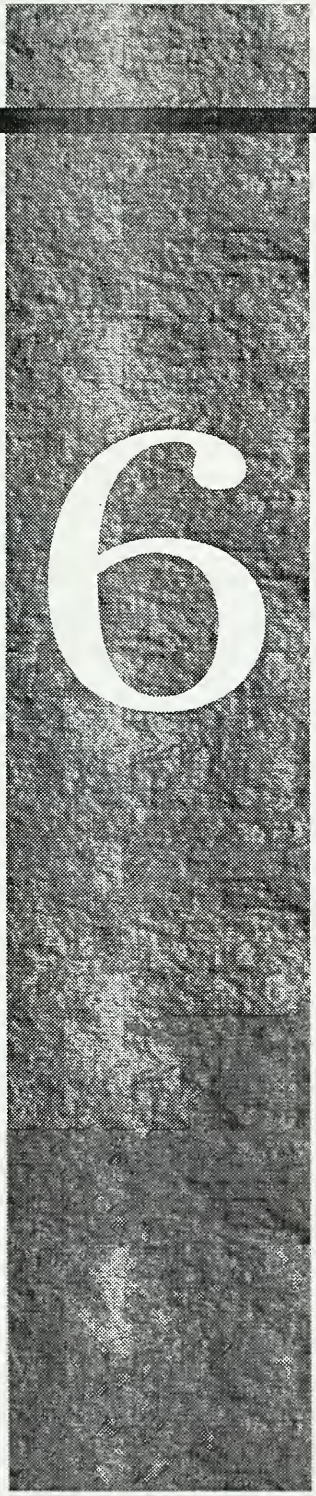

6 CONCLUSIONS

CHAPTER 6

CONCLUSIONS

The following conclusions are provided:

a) The local municipality and the regional MOEE office are the main agencies to be contacted regarding the requirements for hydrogeological studies in support of development applications.

b) The types of sewage and water servicing for a development proposal must be established as a prerequisite to undertaking hydrogeological studies. This must be established in conjunction with the municipality through a 'servicing options report' or municipal wide sewage and water servicing plans.

c) The major issues affecting hydrogeological studies for land development proposals include:

   i) water supply,
   ii) sewage systems,
   iii) ground water recharge and impacts on associated (linked) natural features, and
   iv) existing soil and ground water contamination.

d) Agencies other than the MOEE and the local municipality may need to be consulted regarding issues related to hydrogeological studies. These include:

   i) Regional Municipalities,
   ii) Health Units,

iii) Ministry of Natural Resources,
iv) Conservation Authorities,
v) Ministry of Agriculture and Food, and
vi) other agencies such as Niagara Escarpment Commission.

e) Specific criteria and guidelines for determining baseflow impacts on surface waterbodies need to be established.

f) Hydrogeological study components such as water supply and sewage system assessments need to be integrated and take into account related aspects of development such as storm water management, grading plans and site design.

g) There is an ongoing need for the exchange and dissemination of information pertaining to changes in MOEE guidelines, policies, regulations and legislation and MOEE structure and mandate.

h) Information exchange between government agencies, the research community and the consulting industry will continue to play an important role in providing the best level of understanding of hydrogeological issues and in the development of methods and study approaches in addressing these issues as they relate to land development. A data base of studies and reports should be established.

APPENDIX A

MOEE REGIONAL AND DISTRICT OFFICES

APPENDIX A

MOE CRITERIA GUIDELINES TO BE USED IN DECOMMISSIONING OR CLEANING-UP SITES IN ONTARIO

The development of criteria for setting clean-up standards to be adopted at decommissioning and clean-up sites in Ontario is on-going. There are criteria guidelines for soil, surface water, ground water and air contamination.

Soils Upper Levels of Normal Data and Clean-up Guidelines

Table A-1 lists upper limits of normal concentrations in soils for a range of heavy metals. Where ambient background levels of on-site contaminants cannot be reasonably ascertained by a local sampling program, background levels can be defined according to the values in the table for the given parameters. The Phytotoxicology Section of MOE's Air Resources Branch should be contacted regarding on-going work to develop additional contaminant guidelines for upper limits of normal concentrations in soil.

TABLE A-1

Contaminant Guidelines Representing Upper Limits of Normal Concentrations in Ontario Surface Soil.

Parameter	Urban	Rural
Antimony	8	1[2]
Arsenic	20	10
Boron	15	10[2]
Cadmium	4	3,4[1]
Chromium	50	50
Cobalt	25[3]	25
Copper	100	60
Iron (%)	3.5[3]	3.5
Lead	500	150
Magnesium (%)	-	1
Manganese	700	700,1000[1]
Mercury	0.5	0.15
Molybdenum	3[5]	2[2]
Nickel	60[3]	60
Selenium	2	2
Sulphur (%)	-	0.1
Vanadium	70	70
Zinc	500	500

Notes:

[1] Where two values are shown, the first is based mainly on Southern Ontario data while the second is based on NE Region data.

[2] Provisional guideline estimated from range of results, pending additional data.

[3] Rural results higher than urban results - urban guideline based on rural results.

[4] For comparison with all of the above guidelines except sulphur, analyses should be conducted using an approved strong mixed-acid digestion procedure. For sulphur, analyses should be conducted using an approved combustion with either IR or titrimetric detection procedure. Contact Laboratory Services Branch of MOE for information on acceptable methods.

[5] All units are in ppm (μg/g), dry weight, unless otherwise stated.

Tables A-2 and A-3 list soil clean-up guidelines that may be used to assist in developing clean-up criteria at sites to be decommissioned or cleaned-up. These guidelines relate predominantly to inorganic materials. Where guidelines are not given for the materials listed, or materials are not included on the list, the Phytotoxicology Section of the Air Resources Branch of the Ministry of the Environment may be able to assist the proponent in the establishment of a criteria level on a site-specific basis. As additional soil clean-up guidelines are developed or adopted for use in Ontario, particularly organics, they will be incorporated into Tables A-2 and A-3.

Soils or sediments to be disposed of as wastes should be classified according to the requirements of Regulation 309. In particular, soils or sediments with elevated levels of any parameters listed in Schedule 4 of Regulation 309 should be subjected to a leachate extraction test according to the protocol detailed in the Regulation. Under the leachate extraction test, soils will be classified in one of the waste categories defined in Regulation 309, and should be managed accordingly. The Waste Management Branch of MOE can provide methodological assistance in the sampling of soils for Regulation 309 purposes. Waste Management Branch can also advise as to appropriate disposal methods for soils with elevated levels of parameters that are not included on Schedule 4 of Regulation 309.

TABLE A-2
CLEAN-UP GUIDELINES FOR SOILS

Parameter[2]	Criteria for Proposed Land Use[1/3]			
	Agricultural/Residential/ Parkland[4]		Commercial/Industrial	
	Medium & Fine Textured Soils	Course Textured Soils[5]	Medium & Fine Textured Soils	Course Textured Soils[5]
pH (recommended range)	6-8	6-8	6-8	6-8
EC (mS/cm)[7]	2	2	4	4
SAR[8]	5	5	12	12
Arsenic	25	20	50	40
Cadmium	4[1a]	3[1a]	8[1a]	6[1a]
Chromium (VI)	10	8	10	8
Chromium (total)	1000	750	1000	750
Cobalt	50	40	100	80
Copper	200[1b]	150[1b]	300	225
Lead	500[1a]	375[1a]	1000[1a]	750[1a]
Mercury	1[1a]	0.8[1a]	2[1a]	1.5[1a]
Molybdenum	5[1b]	5[1b]	40	40
Nickel	200	150	200	150
Nitrogen (%)	0.5[9]	0.5[9]	0.6[9]	0.6[9]
Oil and Grease (%)	1[6]	1[6]	1[6]	1[6]
Selenium	2[1b]	2[1b]	10	10
Silver	25	20	50	40
Zinc	800	600	800	600

Notes:

1 Clean-up guidelines recommended by the Phytotoxicology Section, Air Resources Branch, Ministry of the Environment. The guidelines are based primarily on phytotoxicity except for ([1a]) based on human health, and ([1b]) based on health of grazing animals.

2 All units are in ppm (µg/g), dry weight, unless otherwise stated.

3 For comparison with these guidelines, analyses for metal and metalloids must be conducted using an approved strong, mixed-acid digestion procedure. Contact the Laboratory Services Branch of MOE if in doubt about acceptable methods.

4 Guidelines have been endorsed by the OMAF/MOE/MOH Sludge Utilization Committee.

5 Defined as greater than 70% sand and less than 17% organic matter.

6 Guideline given is for fresh oil; for weathered oil (min. 2 yr. exposed on site), the guideline is 2%.

7 EC = electrical conductivity (saturation extract).

8 SAR = sodium adsorption ratio.

9 If nitrogen levels exceed the guidelines, the mineralization of the soils should be evaluated. Additions of nitrogen-based fertilizer may be counter-productive.

TABLE A-3

PROVISIONAL CLEAN-UP GUIDELINES FOR SOILS

Parameter[2]	Criteria for Proposed Land Use[1/3/4]			
	Agricultural/Residential/ Parkland		Commercial/Industrial	
	Medium & Fine Textured Soils	Course Textured Soils[5]	Medium & Fine Textured Soils	Course Textured Soils[5]
Antimony	25	20	50	40
Barium	1000	750	2000	1500
Beryllium	5	4	10	8
Vanadium	250	200	250	200

Notes:

[1] These guidelines are tentative: actual permissible levels of parameters in other situations may vary according to site-specific circumstances. Further information on the application of these guidelines may be obtained from the Phytotoxicology Section of Air Resources Branch, Ministry of the Environment.

[2] All units in ppm (μg/g), dry weight.

[3] For comparison with these guidelines, analyses must be conducted using an approved strong, mixed-acid digestion procedure. Contact the Laboratory Services Branch of MOE if in doubt about acceptable method.

[4] These provisional guidelines apply to soil of minimum pH 6.

[5] Defined as greater than 70% sand and less than 17% organic matter.

Groundwater and Surface Water Contaminant Criteria

Objectives for groundwater and surface water in Ontario are given in "Water Management: Goals, Policies, Objectives and Implementation Procedures or the Ministry of the Environment", available from local MOE offices or from Water Resources Branch, Ministry of the Environment. This document should be used in conjunction with MOE policies on "The Incorporation of The Reasonable Use Concept Into The Groundwater Management Activities of The Ministry of The Environment" and "The Resolution of Groundwater Quality Interference Problems", which are available from local MOE offices or the Waste Management Branch of MOE.

Air Contaminant Criteria

Regulation 308 of the Environmental Protection Act governs air quality in Ontario. Schedule 1 of the Regulation provides air quality criteria. The criteria are based on a "point-of-impingement" concept. The methodology for calculating concentration at the point-of-impingement is provided in the Regulation. The Regulation is currently undergoing a public review and public consultation process that may result in changes to the current approach.

The Ministry of the Environment is continually upgrading its contaminant criteria guidelines. Decommissioning and site clean-up proponents should verify with the Ministry that the contaminant guidelines and criteria outlined in this document are current at the time of a decommissioning or site clean-up.

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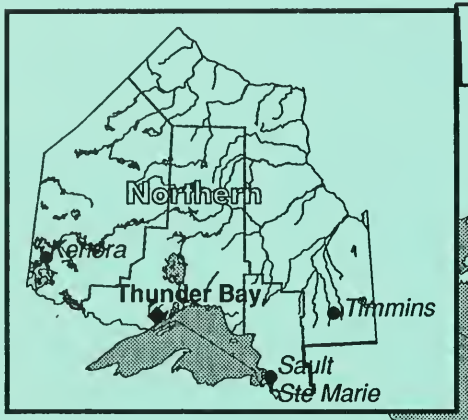
MOEE Regions and Districts



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MICROFICHE NO.		WATER RESOURCES GROUND-WATER PUBLICATIONS
		Water Resources Reports
256-79	*1	Water Resources of the Big Otter Creek Drainage Basin(s), by U. Sibul, 91 pp. (1969).
257-79	*2	Water Resources of the Big Creek Drainage Basin, by T.J. Yakutchik and W. Lammers, 172 pp. (1970).
258-79	*3	Water Resources of the Upper Nottawasaga River Drainage Basin, by U. Sibul, K. Goff and A.V. Choo-Ying, 128 pp. (1971).
242-79	4	Evaluation of the Ground Water Storage Capacity in the Soper Creek Sub-basin Using the Physical Parametric Approach, by M. Barouch, 45 pp. (1971).
259-79	*5b	The Hydrogeology of the IFYGL Forty Mile and Oakville Creeks Study Areas, by R.C. Ostry, 44 pp. (1979).
487-79	5c	The Hydrogeology of the IFYGL Duffins Creek Study Area, by R.C. Ostry, 39 pp. (1979).
75-0422	*5d	A Hydrogeological Study along the North Shore of Lake Ontario in the Bowmanville-Newcastle Area, by S.N. Singer, 72 pp. (1974).
972-81	5e	The Hydrogeology of the IFYGL Moira River, Wilton Creek and The Thousand Islands Study Areas, by R.C. Ostry, 40 pp. (1981).
260-79	*6	Water Resources of the Moira River Drainage Basin, by U. Sibul, K. Goff and A.V. Choo-Ying, 115 pp. (1974).
261-79	*7	Geology and Ground Water Resources of the Wilton Creek IHD Representative Drainage Basin, by Gunther Funk, 96 pp. (1977).
262-79	*8	Ground Water Resources of the Duffins Creek-Rouge River Drainage Basins, by U. Sibul, K.T. Wang and D.J. Vallery, 109 pp. (1978).
263-79	9a	Geology and Water Resources of the Bowmanville, Soper and Wilmot Creeks IHD Representative Drainage Basin, by Gunther Funk, 113 pp. (1977).
1585-82	*9b	Evaluation of the Ground Water Responses Applied to the Bowmanville Soper and Wilmot Creeks IHD Representative Drainage Basin, by Gunther Funk, 233 pp. (1977).
264-79	*10	Hydrogeology and Ground Water Model of the Blue Springs Creek I.H.D. Representative Drainage Basin, by J.M.H. Coward and M. Barouch, 108 pp. (1978).

MICROFICHE NO.		WATER RESOURCES GROUND-WATER PUBLICATIONS
		Water Resources Reports (cont'd)
265-79	11a	Northern Ontario Water Resources Studies, General Characteristics and Frequency Analyses of Streamflows, by V.I. Chin and J.D. Eddie (1978).
266-79	11b	Northern Ontario Water Resources Studies, Ground-Water Resources, by K.T. Wang and V.I. Chin, 121 pp. (1978).
267-79	11c	Northern Ontario Water Resources Studies, The Water Quality of Selected Lakes in the Arctic Watershed of Ontario, by A.C. Roy, 95 pp. (1979).
629-80	12	Geology and Water Resources of the East and Middle Oakville Creeks IHD Representative Drainage Basin, by Gunther Funk, 68 pp. (1979).
759-80	13	Water Resources of the South Nation River Basin by V.I. Chin, K.T. Wang and D.J. Vallery (1980).
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213-79	*1	Ground Water in Ontario 1953 and 1954, 1961, 302 pp.
214-79	*2	Ground Water in Ontario 1955 and 1956, 1963, 377 pp.
215-79	*3	Ground Water in Ontario 1957, 1965, 205 pp.
216-79	*4	Ground Water in Ontario 1958, 1966, 377 pp.
217-79	*5	Ground Water in Ontario 1959, 1966, 320 pp.
218-79	*6	Ground Water in Ontario, Southwestern Area 1960-1963, 1968, 485 pp.
219-79	*2-7	Ground Water in Ontario, South Central Area 1960-64, 1969, 605 pp.
220-79	*2-8	Ground Water in Ontario, Southeastern Area 1960-64, 1970, 307 pp.

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		Water Resources Bulletins (cont'd)
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222-79	*2-10	Ground Water in Ontario, Southwestern Area 1964-67, 1970, 538 pp.
223-79	*2-11	Ground Water in Ontario, South Central Area, 1965-67, 1971, 408 pp.
200-79	*2-12	Water Well Records for Ontario - Durham, Northumberland, Victoria, 1946-69, 1975, 452 pp.
74-0190	*2-13	Water Well Records for Ontario - Haliburton, Peterborough, 1946-69, 1974, 278 pp.
201-79	*2-14	Water Well Records for Ontario - Hastings, Lennox and Addington, Prince Edward, 1946-1972, 1976, 491 pp.
202-79	*2-15	Water Well Records for Ontario - Frontenac, Lanark, Renfrew, 1946-69, 1974, 403 pp.
203-79	*2-16	Water Well Records for Ontario - Regional Municipality of Ottawa-Carleton, 1946-1972, 1976, 553 pp.
204-79	*2-17	Water Well Records for Ontario - Leeds and Grenville, 1946-1972, 1976, 311 pp.
205-79	*2-18	Water Well Records for Ontario - Dundas, Glengarry, Prescott, Russell, Stormont, 1946-1972, 1977, 263 pp.
206-79	*2-19	Water Well Records for Ontario - Essex, 1946-1974, 1977, 223 pp.
207-79	*2-20	Water Well Records for Ontario - Kent and Lambton, 1946-1974, 1977, 608 pp.
208-79	*2-21	Water Well Records for Ontario - Regional Municipalities of Halton and Peel, 1978, 501 pp.
209-79	*2-22	Water Well Records for Ontario - Elgin, Middlesex, 1946-1975, 1978, 609 pp.
210-79	*2-23	Water Well Records for Ontario - Regional Municipality of Haldimand-Norfolk, 1946-1975, 1978, 273 pp.
486-79	*2-24	Water Well Records for Ontario - Huron, Oxford, Perth, 1946-1976, 1979, 641 pp.
846-81	2-25	Water Well Records for Ontario - Bruce, Dufferin and Grey, 1946-1977, 1981, 674 pp.

MICROFICHE NO.		WATER RESOURCES GROUND-WATER PUBLICATIONS
		Water Resources Bulletins (cont'd)
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5072-85	2-200	Flowing Wells in Ontario, 1946-1976.
211-79	*2-101	Data for Observation Wells in Ontario 1974
212-79	*2-102	Data for Observation Wells in Ontario 1975
166-79	*2-103	Data for Observation Wells in Ontario 1976
336-79	*2-104	Data for Observation Wells in Ontario 1977
550-80	*2-105	Data for Observation Wells in Ontario 1978
970-81	*2-106	Data for Observation Wells in Ontario 1979
1840-82	2-107	Data for Observation Wells in Ontario 1980
		Ground-Water Probability Map Series
	3100	Ground-Water Probability, County of Brant, 1977
	3101	Ground-Water Probability, County of Bruce, 1986
	3105	Ground-Water Probability, Regional Municipality of Durham, 1986
	*3106-1-4	Ground-Water Probability, County of Elgin, 1972
	*3107-1	Ground-Water Probability, County of Essex, 1971
	3111	Ground-Water Probability, County of Grey, 1984
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*3118-1	Ground-Water Probability, County of Lambton, 1970
3124	Ground-Water Probability, Region of Haldimand-Norfolk (Western Portion), 1979
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78-6	Guelph-Lockport Aquifer, 1978
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5926-2	Lake Ontario Drainage Basin - Overburden Well Yields, 1973

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S-122	Susceptibility of Ground Water to Contamination St. Marys Sheet	1985
S-123	Susceptibility of Ground Water to Contamination Wallaceburg Sheet	1986
S-124	Susceptibility of Ground Water to Contamination Durham Sheet	1986
S-125	Susceptibility of Ground Water to Contamination Palmerston Sheet	1986

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Water Wells & Ground Water Supplies In Ontario (Booklet), by G. Funk, W.A. McClenaghan and C. Holland (1980), revised by F.P. McKenna (1987)

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Water Wells in Ontario: Installation of Well Pumps (Brochure)

Water Wells and Groundwater Supplies: The Protection of Water Quality in Bored and Dug Wells (Inforamtion sheet)

Water Wells and Groundwater Supplies: The Protection of Water Quality in Drilled Wells (Information sheet)

Water Wells and Groundwater Supplies: Recommended Methods for Plugging Abandoned Water Wells (Information sheet)

PESTICIDES IN DRINKING WATER/GROUNDWATER

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Pesticides In Ontario Drinking Water - 1985, (1987)

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OTHER TOPICS

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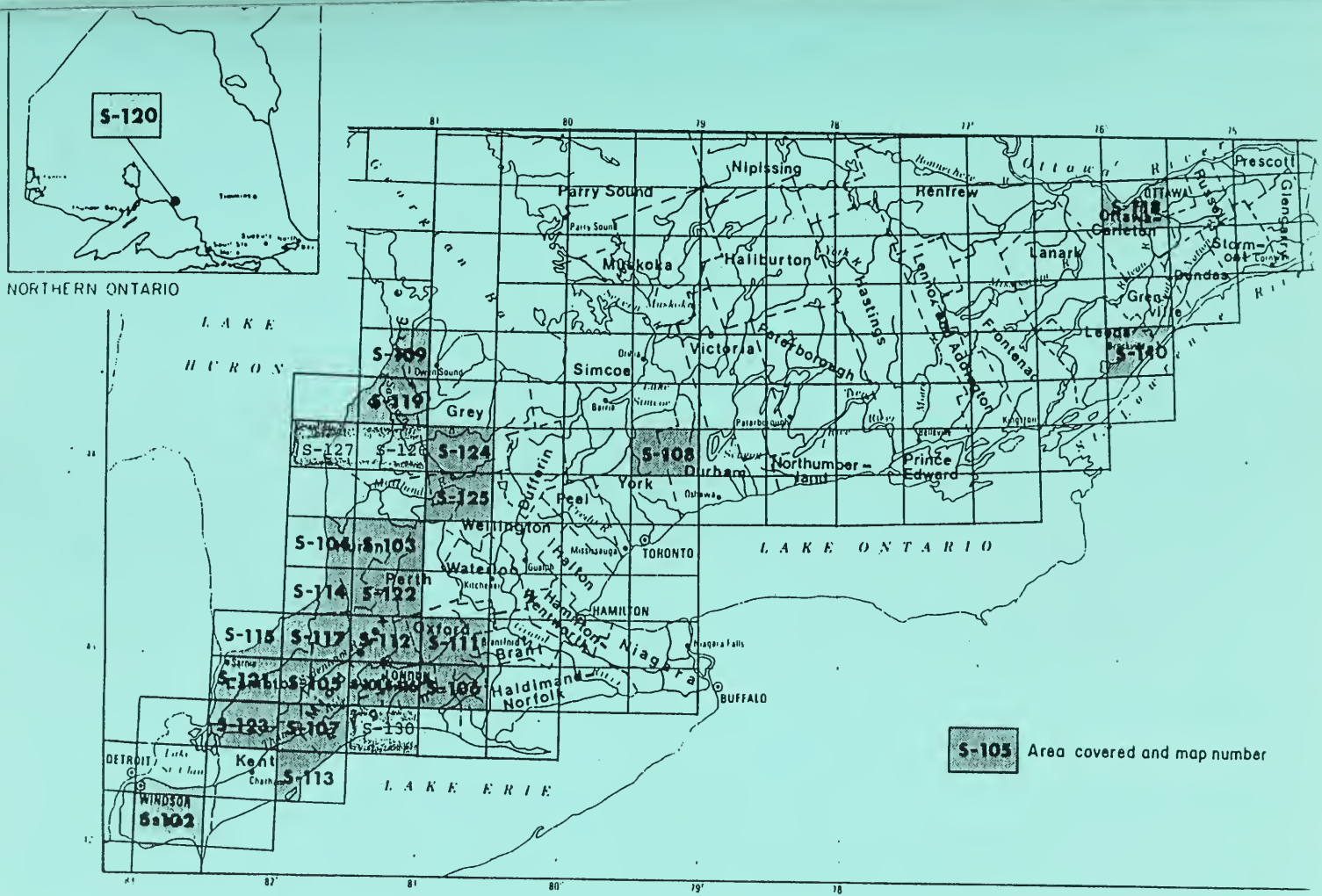

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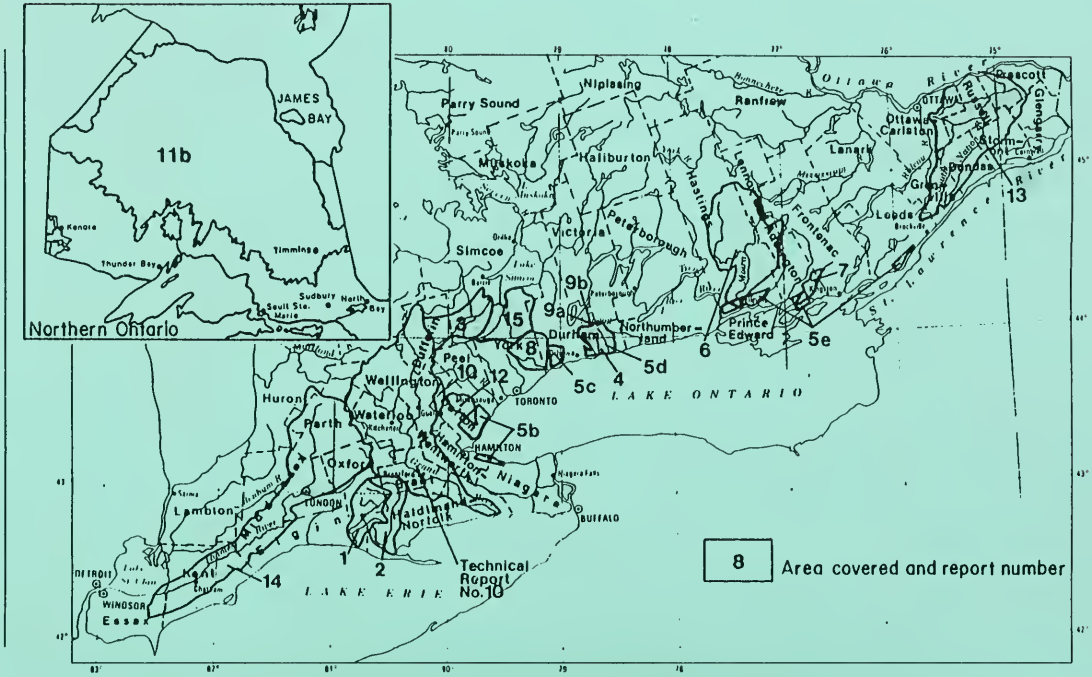

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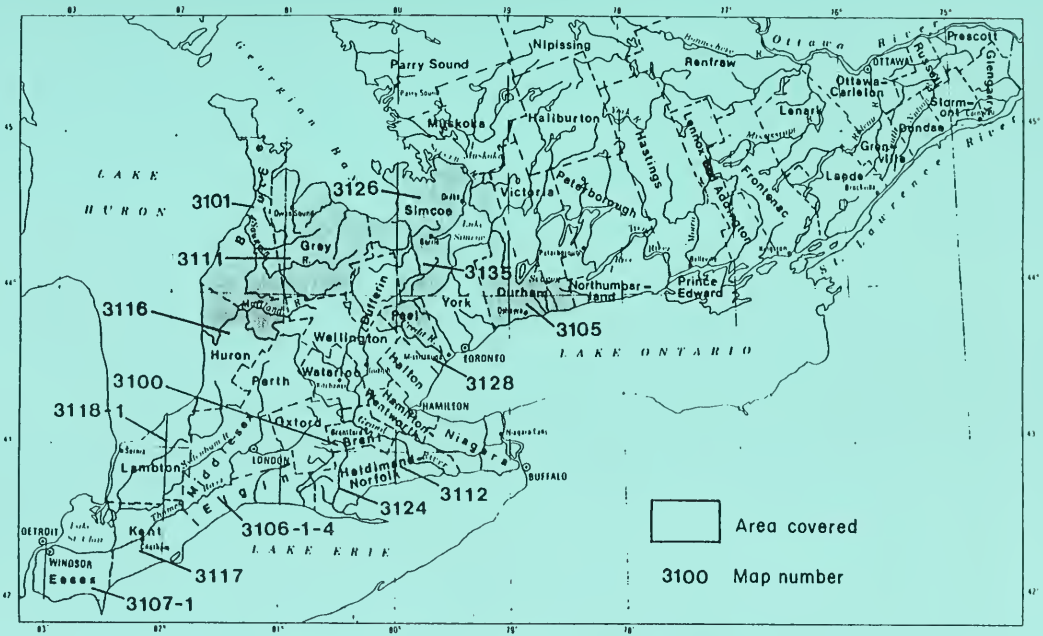

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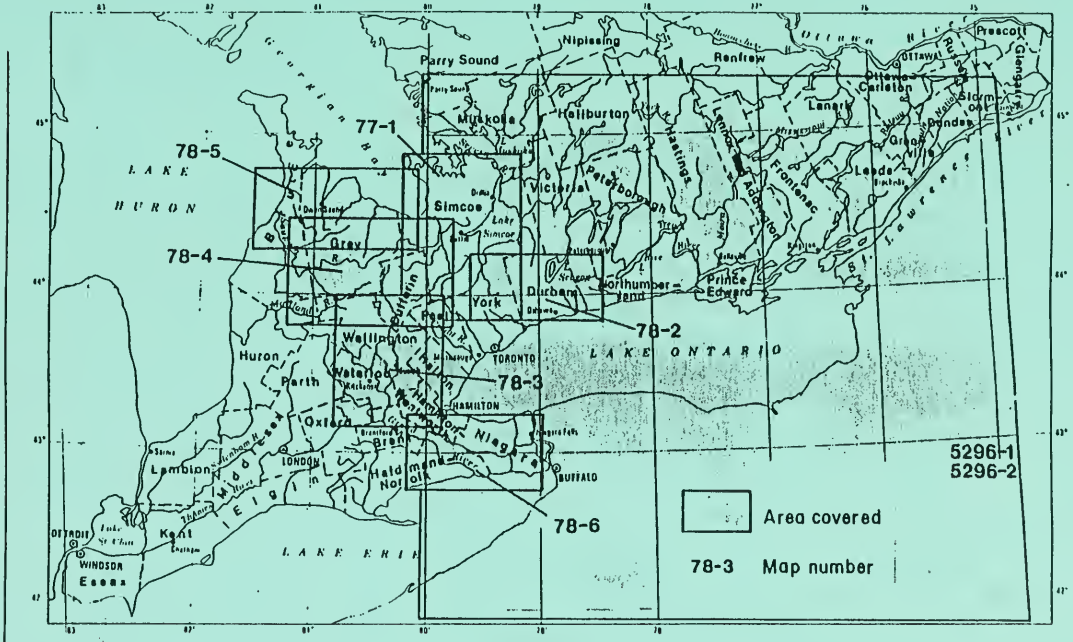

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APPENDIX A

PROVINCIAL WATER QUALITY OBJECTIVES

July, 1994

PREFACE

This document provides both a listing of MOEE's surface water quality criteria and supports the MOEE publication *Water Management: Policies, Guidelines, Provincial Water Quality Objectives of the Ministry of Environment and Energy* (1994). Questions on the contents of this document should be directed to the Environmental Standards Section, Standards Development Branch, Ministry of Environment and Energy (MOEE).

This document consolidates all current MOEE Provincial Water Quality Objectives (PWQOs) and Interim PWQOs. It contains all the current PWQOs and Interim PWQOs. **All earlier listings of PWQOs are replaced by this publication.** Users of this publication should also be aware that some earlier versions of Interim PWQOs may have been changed and that some have been withdrawn in this current publication.

With this publication, MOEE has adopted new, simplified terminology (i.e. PWQO and Interim PWQO) to replace the terminology previously in use.

As well as the PWQOs themselves, this publication provides important supporting information, including: a definition of what PWQOs are, a summary of how they are set, practical considerations associated with PWQO development, the availability of scientific rationale documents for the PWQOs, and the use and implementation of PWQOs. The document also provides information on recreational objectives, general narrative objectives, fish tissue residue criteria, and other water quality objectives and guidelines that should be considered.

ACKNOWLEDGEMENTS

This document was compiled by G. Rutherford, D. Spry and W. Scheider (Environmental Standards Section, Standards Development Branch, MOEE) and J. Ralston (Program Support Section, Program Development Branch, MOEE). We thank the MOEE Aquatic Criteria Development Committee, S. Salbach (Program Development Branch), G. Horsnell (Laboratory Services Branch), and M. Brodsky (Ministry of Health) for their input and comments.

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INTRODUCTION

Contaminants that impair water quality are a major environmental concern. Many of these contaminants are toxic to aquatic life such as fish and aquatic invertebrates, in both the water column and sediment. Others are persistent and/or bioaccumulative and can cause food-web effects when fish, wildlife, birds and people consume contaminated organisms. Still other contaminants may impair the human use of the water or upset the natural balance of the aquatic ecosystem.

Contaminants may enter the water from many sources. Industrial and municipal discharges of wastewater, contaminated runoff from urban and agricultural areas, deposition of air pollutants, lakefilling, leachate from landfill sites and industrial areas, and pesticide use are all important sources. Some of these contaminants are naturally occurring, and their presence in the water is the result of natural processes. Managing contaminants that impair water quality is an important component of managing the waters of the Province.

The MOEE goals, policies and guidelines for the management of the Province's water resources are outlined in *Water Management* (1994). The surface water policies require a minimum acceptable level of water quality to be defined for the waters of the Province. This defined level of water quality provides a baseline for assessing the quality of the waters of the Province and acts as a simple, surrogate measure of ecosystem health. The minimum acceptable level of water quality is represented by the Provincial Water Quality Objectives (PWQOs).

1.1 What are PWQOs?

PWQOs are numerical and narrative ambient surface water quality criteria. They are applicable to all waters of the province (e.g. lakes, rivers and streams) except in those areas specifically designated, such as areas influenced by MOEE approved point source discharges. In specific instances where groundwater is discharged to surface waters, PWQOs may also be applied to the groundwater.[1] PWQOs represent a desirable level of water quality that the MOEE strives to maintain in the surface waters of the Province. In accordance with the goals and policies in *Water Management* (1994), PWQOs are set at a level of water quality which is protective of all forms of aquatic life and all aspects of the aquatic life cycle during indefinite exposure to the water. The PWQOs for protection of recreational water uses are based on public health and aesthetic considerations.

The PWQOs are listed in Table 2 of this document.

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[1] - Most often, groundwater is assessed using Ontario Drinking Water Objectives or appropriate agricultural guidelines, depending on the specific use for the groundwater.

1.2 How are PWQOs Set?

The MOEE has established a comprehensive process for setting Provincial Water Quality Objectives. This process is detailed in the MOEE publication *Ontario's Water Quality Objective Development Process* (1992). The document also describes the process used to set Interim PWQOs (described below). The process to establish ambient surface water quality criteria is a practical, but conservative method of estimating a safe concentration even when limited toxicity data are available.

1.2.1 Setting Provincial Water Quality Objectives

Through a review of the global aquatic toxicological literature, a database of the available information is established. PWQOs are established when a defined minimum information base representing the following effects is available: aquatic toxicity; bioaccumulation; and mutagenicity. The final PWQO is based on the lowest effect concentration reported for any of the above endpoints with an added safety factor. Additional information on taste and odour in water, tainting of fish flesh, impacts on wildlife and recreation, if available, is taken into consideration and may influence the final PWQO value. Draft scientific criteria documents for the development of PWQOs are distributed for international scientific peer review. Public review, as outlined in the Environmental Bill of Rights, is also sought.

1.2.2 Setting Interim Provincial Water Quality Objectives

For many substances of concern, there is insufficient toxicological information available to prepare a PWQO. In these cases, an Interim Provincial Water Quality Objective is established. To achieve a consistent approach in establishing environmental protection values for substances with limited information, a prescriptive process for setting Interim PWQOs was developed. This process parallels the PWQO setting process by employing toxicological data as well as considering bioaccumulation, mutagenicity and other factors. Generally, Interim PWQOs are developed with the intention of upgrading them to PWQO status as sufficient information becomes available. The Interim PWQO is based on the lowest effect concentration reported and an "uncertainty factor". The size of the uncertainty factor reflects the quality and quantity of data available, and the potential of the substance to bioaccumulate. Once documentation is complete to the satisfaction of MOEE staff, draft Interim PWQOs are also distributed for peer and public review as described for PWQO, above. Users of these Interim PWQOs based on draft scientific criteria development documents must employ due caution as the Interim PWQOs are subject to change based on review comments and additional data.

1.2.3 Setting Interim PWQOs to Meet Emergency Needs

Occasionally, to meet emergency needs, a numerical criterion is required for a substance that does not have a PWQO or Interim PWQO. In such cases, MOEE has an accelerated procedure using the same approach described above for setting Interim PWQOs. These Interim PWQOs are based on information derived from a search of electronic databases and the best information

at hand. Unlike full PWQOs or Interim PWQOs set in the usual manner, the Interim PWQOs set for emergency purposes are not subject to peer review or formal Ministry publication. Users of Interim PWQOs must be prepared to employ due caution in the application of these values and recognize that the values may substantially change when the Interim PWQOs set for emergency purposes are ultimately converted to PWQOs.

1.3 What are the Recreational Objectives Based on?

The Objectives for the protection of recreational water uses are based on public health and aesthetic considerations. The basis of the objectives for the protection of recreational water uses is that the use of water for swimming, bathing and other recreational activities requiring immersion of the user should not cause disease in the human user nor should use of the water cause impairments which might lead to physical injury (e.g. from poor underwater visibility) or irritation, or to loss of enjoyment of the water. The potential for harmful effects from exposure to chemical substances during recreational uses is unknown at present, but will be considered when scientific information becomes available.

The Recreational Objectives are listed alphabetically in Table 2 of this document. Specific recreational objectives are available for: Aesthetics, pH, Water Clarity and *Escherichia coli* (for ease of use, *E. coli* is cross-referenced under the headings Bacteria, Microbiology, Public Health Considerations, and Swimming and Bathing).

1.4 What are some of the Practical Considerations Associated with PWQOs & Interim PWQOs?

PWQOs and Interim PWQOs are conservative estimates of a level of water quality which is fully protective of all aspects of aquatic life. As such, they are often used as surrogates for assessing aquatic ecosystem health. For example, exceeding PWQOs may indicate that environmental conditions are degraded or impaired for supporting aquatic life. Since direct measurements of ecosystem health are also desirable, MOEE, in cooperation with other agencies, is investigating the development of biological indicators that more directly assess ecosystem health or status.

The PWQOs and Interim PWQOs are set for individual chemicals or homologous groups of chemicals and, for the most part, do not account for joint toxicity (i.e. additive, synergistic or antagonistic effects) resulting when a mixture of hazardous substances is present in a waterbody. Toxicity of mixtures is a complex area which has not yet been fully evaluated by the MOEE. Water quality managers should consider that waters with a quality at or near the Objectives for several parameters may not afford adequate protection to aquatic life. In these situations, joint toxicity models may be of some use. Alternatively, the empirical approach of monitoring the toxicity of whole effluent or receiving water samples, as well as bioassessment, may be useful in assessing the joint toxicity of complex mixtures.

PWQOs and Interim PWQOs do not take into account analytical limits, treatability or removal potential, socio-economic factors, background concentrations, or potential transport of

contaminants among air, water and soil. These factors are considered in the policies found in *Water Management* (1994), in the supporting implementation procedures for *Water Management* (1994), and in the site-specific application of PWQOs by environmental managers familiar with local conditions. Detailed implementation procedures related to point-source discharge requirements are found in the MOEE publication *Deriving Receiving-Water Based, Point-Source Effluent Requirements for Ontario Waters* (1994).

1.5 Where can Details on the Rationale for the PWQOs and Interim PWQOs be Found?

Each PWQO has been set on the basis of a review of the available toxicological information base. These reviews are available in the form of a scientific criteria document for individual chemicals or groups of chemicals. Supporting discussions on the establishment of some older PWQOs have been taken from several sources and are compiled into a single document, available from the Ministry of the Environment and Energy, entitled: *Rationale for the Establishment of Ontario's Provincial Water Quality Objectives* (1979). Several of the Interim PWQOs have published scientific criteria development documents available for them. These documents can be obtained by contacting the Environmental Standards Section, Standards Development Branch of MOEE.

1.6 How are PWQOs and Interim PWQOs Used?

PWQOs and Interim PWQOs are intended to provide guidance in making water quality management decisions such as the designation of the surface waters of the Province which should not be further degraded. They are often used as the starting point in deriving waste effluent requirements included in Certificates of Approval and other instruments issued to regulate effluent discharges. They are also used to assess ambient water quality conditions, infer use impairments and assist in assessing spills. Although PWQOs and Interim PWQOs are not legal standards *per se*, they are employed as the starting point in the establishment of acceptable wastewater loading limits on a site-specific basis. These loading limits, once they are incorporated in Certificates of Approval or other similar instruments, are legally enforceable.

Users of PWQOs and Interim PWQOs are occasionally faced with situations where the application of PWQOs and Interim PWQOs is problematic. Typical of these problems are things like: PWQOs below analytical detection limits; unavailability of analytical methods; PWQOs that are more stringent than background concentrations, including waterbodies with apparently healthy aquatic communities; and, determining natural background levels (defining background).

In addition to MOEE policies which assist in dealing with many of these situations (see *Water Management*, 1994), there are a number of assessment and management options used by MOEE staff to deal with these problems. Some examples of these include: whole effluent toxicity testing, using aquatic toxicity data for screening discharges, applying site-specific guidance for nutrients and metals, and biomonitoring studies.

Suggestions and advice on the these techniques can be obtained by contacting the Environmental Standards Section, Standards Development Branch, MOEE.

1.7 What are the General Narrative Objectives for the Protection of Water Quality?

Narrative objectives have been developed for the general protection of aquatic resources. They are subjective requirements which ensure that the waters of the province are free from certain human-induced objectionable conditions. The narrative objectives assist in managing contaminants which may cause undesirable conditions, but which may be difficult to quantify or to identify as specific chemical compounds. The General Narrative Objectives can be found in Table 1.

1.8 What are Fish Tissue Residue Criteria?

Fish tissue residue criteria are used for assessing the significance of contaminant residues in fish tissues to fish populations and to wildlife consumers of fish (for example, birds such as osprey and eagle). At concentrations above the criteria, the contaminated fish tissue becomes increasingly unacceptable as a food source. These criteria are aimed at minimizing effects for those contaminants which are biomagnified through the food-web. Currently, values for mercury and DDT are available for the protection of fish-consuming birds and, in the case of mercury, aquatic life. Additional fish tissue residue criteria should be available in the future.

MOEE's Fish Tissue Residue Criteria are found in Table 3 of this document.

Fish tissue residue criteria for the protection of human consumers of sport fish are presented in the *Guide to Eating Ontario Sport Fish.* The current edition is 1993-94. These guidelines are based on human health consumption limits developed by Health Canada.

Information on the *Guide to Eating Ontario Sport Fish* and guidelines for specific contaminants can be obtained from the MOEE Environmental Monitoring and Reporting Branch at (416) 314-7886.

1.9 Are there Other Objectives and Guidelines that Should be Considered?

In addition to the PWQOs and Interim PWQOs, water resource managers can employ, where appropriate, a variety of other objectives or guidelines for assessing water quality that relate to specific uses. They include:

1.9.1 Ontario Drinking Water Objectives

The primary purpose of the Ontario Drinking Water Objectives is for the protection of public health. The Ontario Drinking Water Objectives are normally applied to treated drinking water supplies. Any water intended for human consumption should not contain any disease-causing organisms or hazardous concentrations of toxic chemicals or radioactive substances. Aesthetic

considerations may also provide a basis for drinking water objectives since the water should be pleasant to drink. Temperature, taste, odour, turbidity and colour are also important in achieving waters which are aesthetically acceptable.

Other aspects of drinking water quality such as corrosiveness, tendency to form encrustations and excessive soap consumption should be controlled on the basis of economic considerations because of their effects on the distribution system and/or the intended domestic and industrial use of water.

The Ontario Drinking Water Objectives are contained in the MOEE publication *Ontario Drinking Water Objectives* (Revised, 1994). A complete description of the application of Ontario's drinking water requirements is contained in that publication.

Ontario Drinking Water Objectives (Revised, 1994) and *Appendix A - Provincial Water Quality Objectives* (1994) are companion documents. The former contains **treated drinking water objectives**, the latter **ambient surface water quality objectives**. Care should be taken not to confuse the two types of objectives or their use.

All waterbodies (lakes, rivers, or any other surface waters) may be subject to contamination by disease-causing organisms. Consequently, the MOEE recommends that no surface water is considered safe for consumption without prior treatment, including disinfection.

1.9.2 Canadian Water Quality Guidelines (including Agricultural Uses)

The Canadian Water Quality Guidelines were developed in response to a recommendation of the Canadian Council of Resource and Environment Ministers (CCREM) now known as the Canadian Council of Ministers of the Environment (CCME). These guidelines provide basic scientific information about the effects of water quality parameters on a wide variety of uses including: raw water for drinking water supply, recreational water quality and aesthetics, freshwater aquatic life, agricultural uses and industrial water supplies. Resource managers may wish to use this information and the comprehensive supporting text to complement or augment the Provincial Water Quality Objectives and Interim Objectives, and the Ontario Drinking Water Objectives. In particular, for agricultural and industrial water supply, the Canadian Water Quality Guidelines for those uses should be consulted.

1.9.3 Sediment Quality Management Guidelines

Contaminated sediment is a major environmental problem that can seriously impair the health and well-being of benthic organisms, bottom-dwelling fish and, affect predatory fish, wildlife and humans through the food-web. The Ontario MOEE recognizes the need to understand and effectively manage contaminated sediments. To that end, a comprehensive document *Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario*, (1993) provides a management plan composed of Sediment Quality Guidelines and procedures for the application of the Guidelines. The publication also details the protocol employed for setting the Guidelines.

1.9.4 Great Lakes Water Quality Agreement

The Canada-U.S. Great Lakes Water Quality Agreement (GLWQA - 1987) serves as the principle vehicle for ensuring a co-ordinated, binational approach to solving problems with Great Lakes water quality. The GLWQA contains specific water quality objectives which should be considered in assessing the water quality of the Great Lakes.

1.10 Where Both a PWQO and an Interim PWQO Exist

In five instances, both a PWQO and an Interim PWQO are provided for the same substance (i.e. arsenic, cadmium, copper, lead and zinc). In all five cases, the Interim PWQOs are based on **draft** scientific criteria development documents currently under development. While the existence of two values for the same substance may cause some implementation concerns, MOEE believes that it is better to provide the latest information available while awaiting full approval of the updated PWQO. The existing, approved PWQO can be applied in most situations; however, where a greater level of aquatic protection is appropriate, the more stringent Interim PWQO may be used, subject to the discretion of MOEE staff. At the very least, discharge proponents should be aware of the possibility of future requirements becoming more stringent, as these Interim PWQOs are formally approved as PWQOs by MOEE.

References

CCME. 1987-93. Canadian Water Quality Guidelines. Canadian Council of Ministers of the Environment.

Great Lakes Water Quality Agreement of 1978 (revised). As amended by Protocol signed November 18, 1987.

MOE. 1979. Rationale for the Establishment of Ontario's Water Quality Objectives. Ontario Ministry of the Environment.

MOE. 1992. Ontario's Water Quality Objective Development Process. Ontario Ministry of the Environment.

MOEE. 1993. Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario. Ontario Ministry of Environment and Energy.

MOEE. 1993. Guide to Eating Ontario Sport Fish. 1993-94 edition. Ontario Ministry of Environment and Energy.

MOEE. 1994. Ontario Drinking Water Objectives. Revised 1994. Ontario Ministry of Environment and Energy.

MOEE. 1994. Deriving Receiving-Water Based, Point-Source Effluent Requirements for Ontario Waters. Ontario Ministry of Environment and Energy.

Table 1 - General Narrative Objectives

All waters shall be free from contaminating levels of substances and materials attributable to human activities which in themselves or in combination with other factors can:	• Settle to form objectionable deposits;
	• Float as debris, scum or oil or other matter to form nuisances;
	• Produce objectionable colour, odour, taste or turbidity;
	• Injure, are toxic to, or produce adverse physiological or behavioral responses in humans, animals or plants; or
	• Enhance the production of undesirable aquatic life or result in the dominance of nuisance species.

TABLE 2 - Table of PWQOs and Interim PWQOs

Acetamide, N-(2-Hydroxyphenyl) CAS No. 614-80-2	30 µg/L (Interim PWQO)[a]
Acetanilide CAS No. 103-84-4	100 µg/L (Interim PWQO)[a]
Acrolein CAS No. 107-02-8	0.03 µg/L (Interim PWQO)[a]
Aesthetics CAS No. NA	**PWQO[1]:** **Water used for swimming, bathing and other recreational activities should be aesthetically pleasing. The water should be devoid of debris, oil, scum and any substance which would produce an objectionable deposit, colour, odour, taste or turbidity.**
Aldrin/Dieldrin CAS No. aldrin 309-00-2; dieldrin 60-57-1	0.001 µg/L (PWQO)[1] • PWQO is for the sum of the concentrations of aldrin and dieldrin in water.
Alkalinity CAS No. NA	**PWQO[1]:** **Alkalinity should not be decreased by more than 25% of the natural concentration.**
Aluminum CAS No. 7429-90-5	**Interim PWQO[4]:** ***• At pH 4.5 to 5.5 the Interim PWQO is 15 µg/L based on inorganic monomeric aluminum measured in clay-free samples.** **• At pH >5.5 to 6.5, no condition should be permitted which would increase the acid soluble inorganic aluminum concentration in clay-free samples to more than 10% above natural background concentrations for waters representative of that geological area of the Province that are unaffected by man-made inputs.** ***• At pH >6.5 to 9.0, the Interim PWQO is 75 µg/L based on total aluminum measured in clay-free samples.** *** If natural background aluminum concentrations in water bodies unaffected by man-made inputs are greater than the numerical Interim PWQO (above), no condition is permitted that would increase the aluminum concentration in clay-free samples by more than 10% of the natural background level.** **Note: pH values of <6.5 and >8.5 are outside the range considered acceptable by the PWQO for pH.** See the *Scientific Criteria Document for Development of Provincial Water Quality Objectives and Guidelines - Aluminum* for a discussion of analytical procedures.
Aminoazobenzene, 4- CAS No. 60-09-3	0.8 µg/L (Interim PWQO)[a]
Aminoethyl piperazine CAS No. 140-31-8	2400 µg/L (Interim PWQO)[a]

[a] See Section 1.2.3. This Interim PWQO was set for emergency purposes based on the best information readily available. Employ due caution when applying this value.

[b] See Section 1.2.2. This Interim PWQO is currently under development. The value is subject to change upon publication by MOEE.

1-11 References for criteria development documents - see last page of Table 2.

Ammonia (un-ionized) 20 µg/L (PWQO)[1]

CAS No. 7664-41-7

- The percentages of un-ionized ammonia (NH_3) in aqueous ammonia solution for different temperature and pH conditions are listed in the table below. For example, at 20°C and pH of 8.0, a total ammonia concentration of 500 µg/L would give an un-ionized ammonia concentration of 500 x 3.8/100 = 19 µg/L which is less than the un-ionized ammonia Objective of 20 µg/L.

The table below is taken from Emerson *et al.* 1975[11] but percentages are rounded to two significant figures. The equations given by Emerson *et al.* may be used to interpolate values between those given in the table:

$f = 1/(10^{pKa-pH} + 1)$, where f is the fraction of NH_3

$pKa = 0.09018 + 2729.92/T$, where T = ambient water temperature in Kelvin (K = °C + 273.16)

Results should be converted to percent and rounded to two significant figures. Extrapolations should not be made beyond the ranges of the table.

Note: Under certain temperature and pH conditions, the total ammonia criteria for the protection of aquatic life may be less stringent than the criteria for other beneficial uses (e.g. public water supply).

Percent NH_3 in aqueous ammonia solutions for 0-30 °C and pH 6-10

Temp.	pH								
°C	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5	10.0
0	.0083	.026	.083	.26	.82	2.6	7.6	21.	45.
1	.0090	.028	.090	.28	.89	2.8	8.3	22.	47.
2	.0098	.031	.098	.31	.97	3.0	8.9	24.	49.
3	.011	.034	.11	.34	1.1	3.3	9.6	25.	52.
4	.012	.036	.12	.36	1.1	3.5	10.	27.	54.
5	.013	.040	.13	.39	1.2	3.8	11.	28.	56.
6	.014	.043	.14	.43	1.3	4.1	12.	30.	58.
7	.015	.046	.15	.46	1.5	4.4	13.	32.	60.
8	.016	.050	.16	.50	1.6	4.8	14.	34.	61.
9	.017	.054	.17	.54	1.7	5.2	15.	35.	63.
10	.019	.059	.19	.59	1.8	5.6	16.	37.	65.
11	.020	.064	.20	.63	2.0	6.0	17.	39.	67.
12	.022	.069	.22	.68	2.1	6.4	18.	41.	69.
13	.024	.074	.24	.74	2.3	6.9	19.	43.	70.
14	.025	.080	.25	.80	2.5	7.4	20.	45.	72.
15	.027	.087	.27	.86	2.7	8.0	22.	46.	73.
16	.030	.093	.29	.93	2.9	8.5	23.	48.	75.
17	.032	.10	.32	1.0	3.1	9.1	24.	50.	76.
18	.034	.11	.34	1.1	3.3	9.8	26.	52.	77.
19	.037	.11	.37	1.2	3.6	11.	27.	54.	79.
20	.040	.13	.40	1.2	3.8	11.	28.	56.	80.
21	.043	.14	.43	1.3	4.1	12.	30.	58.	81.
22	.046	.15	.46	1.4	4.4	13.	32.	59.	82.
23	.049	.16	.49	1.5	4.7	14.	33.	61.	83.
24	.053	.17	.53	1.7	5.0	14.	35.	63.	84.
25	.057	.18	.57	1.8	5.4	15.	36.	64.	85.
26	.061	.19	.61	1.9	5.8	16.	38.	66.	86.
27	.065	.21	.65	2.0	6.2	17.	40.	67.	87.
28	.070	.22	.70	2.2	6.6	18.	41.	69.	88.
29	.075	.24	.75	2.3	7.0	19.	43.	70.	88.
30	.081	.25	.80	2.5	7.5	20.	45.	72.	89.

[a] See Section 1.2.3. This Interim PWQO was set for emergency purposes based on the best information readily available. Employ due caution when applying this value.

[b] See Section 1.2.2. This Interim PWQO is currently under development. The value is subject to change upon publication by MOEE.

[1-11] References for criteria development documents - see last page of Table 2.

Aniline CAS No. 62-53-3	**2 µg/L (Interim PWQO)[b]**
Anthracene CAS No. 120-12-7	**0.0008 µg/L (Interim PWQO)[a]**
Antimony CAS No. 7440-36-0	**20 µg/L (Interim PWQO)[b]**
Arsenic CAS No. 7440-38-2	**100 µg/L (PWQO)[1]**
Arsenic (revised) *CAS No. 7440-38-2*	***5 µg/L (Interim PWQO)[b]*** *(See Section 1.10 - Where both a PWQO and an Interim PWQO exist)*
Bacteria	**See *Escherichia coli***
Benzaldehyde CAS No. 100-52-7	**0.09 µg/L (Interim PWQO)[a]**
Benzene CAS No. 71-43-2	**100 µg/L (Interim PWQO)[b]**
Benzidine CAS No. 92-87-5	**20 µg/L (Interim PWQO)[a]**
Benzothiazole CAS No. 95-16-9	**100 µg/L (Interim PWQO)[a]**
Benzo[g,h,i]perylene CAS No. 191-24-2	**0.00002 µg/L (Interim PWQO)[a]**
Benzo[k]fluoranthene CAS No. 207-08-9	**0.0002 µg/L (Interim PWQO)[a]**
Benzyl alcohol CAS No. 100-51-6	**8 µg/L (Interim PWQO)[a]**
Benz[a]anthracene CAS No. 56-55-3	**0.0004 µg/L (Interim PWQO)[a]**
Beryllium CAS No. 7440-41-7	**PWQO[1]:** **Hardness as $CaCO_3$ (mg/L)** / **PWQO (µg/L)** < 75 / 11 > 75 / 1100
Biphenyl CAS No. 92-52-4	**0.2 µg/L (Interim PWQO)[a]**

[a] See Section 1.2.3. This Interim PWQO was set for emergency purposes based on the best information readily available. Employ due caution when applying this value.

[b] See Section 1.2.2. This Interim PWQO is currently under development. The value is subject to change upon publication by MOEE.

[1-11] References for criteria development documents - see last page of Table 2.

Bisphenol A CAS No. 80-05-7	**5 µg/L (Interim PWQO)[a]**
Bis(2-chloroethyl) ether CAS No. 111-44-4	**200 µg/L (Interim PWQO)[a]**
Boron CAS No. 7440-42-8	**200 µg/L (Interim PWQO)[a]**
Bromodichloro-methane CAS No. 75-27-4	**200 µg/L (Interim PWQO)[a]**
Bromoform CAS No. 75-25-2	**60 µg/L (Interim PWQO)[a]**
Bromomethane CAS No. 74-83-9	**0.9 µg/L (Interim PWQO)[a]**
Bromophenyl phenyl ether, 4- CAS No. 101-55-3	**0.05 µg/L (Interim PWQO)[a]**
Butanal CAS No. 123-72-8	**10 µg/L (Interim PWQO)[a]**
Butyl benzyl phthalate CAS No. 85-68-7	**0.2 µg/L (Interim PWQO)[a]**
Cadmium CAS No. 7440-43-9	**0.2 µg/L (PWQO)**
Cadmium (revised) *CAS No. 7440-43-9*	***Interim PWQO[b]:*** *(See Section 1.10 - Where both a PWQO and an Interim PWQO exist)* *Hardness as $CaCO_3$ (mg/L)*: *Interim PWQO (µg/L)* *0 - 100*: *0.1* *> 100*: *0.5*
Camphene CAS No. 79-92-5	**2 µg/L (Interim PWQO)[a]**
Chlordane CAS No. 57-74-9	**0.06 µg/L (PWQO)[1]**

[a] See Section 1.2.3. This Interim PWQO was set for emergency purposes based on the best information readily available. Employ due caution when applying this value.

[b] See Section 1.2.2. This Interim PWQO is currently under development. The value is subject to change upon publication by MOEE.

[1-11] References for criteria development documents - see last page of Table 2.

Chlorine CAS No. 7782-50-5	**2 µg/L (PWQO)[1]** • Total residual chlorine, as measured by the amperometric (or equivalent) method.
Chlorobenzene CAS No. 108-90-7	**15 µg/L (PWQO)[2]** • common synonym monochlorobenzene
Chlorodibromo-methane CAS No. 124-48-1	**40 µg/L (Interim PWQO)[a]**
Chloromethane CAS No. 74-87-3	**700 µg/L (Interim PWQO)[a]**
Chloronaphthalene, 1- CAS No. 90-13-1	**0.1 µg/L (Interim PWQO)[a]**
Chloronaphthalene, 2- CAS No. 91-58-7	**0.2 µg/L (Interim PWQO)[a]**
Chlorophenyl phenyl ether, 4- CAS No. 7005-72-3	**0.05 µg/L (Interim PWQO)[a]**
Chlorpyrifos CAS No. 2921-88-2	**0.001 µg/L (PWQO)[1]** • common synonym - Dursban
Chloro-3-methyl phenol, 4- CAS No. 59-50-7	**3 µg/L (Interim PWQO)[a]**
Chromium CAS No. 7440-47-3	**100 µg/L (PWQO)[1]**
Chrysene CAS No. 218-01-9	**0.0001 µg/L (Interim PWQO)[a]**
Cineole CAS No. 470-82-6	**100 µg/L (Interim PWQO)[a]**
Cobalt CAS No. 7440-48-4	**0.6 µg/L (Interim PWQO)[b]**
Copper CAS No. 7440-50-8	**5 µg/L (PWQO)[1]**

Copper (revised)
CAS No. 7440-50-8

Interim PWQO[b]: *(See Section 1.10 - Where both a PWQO and an Interim PWQO exist)*

Hardness as $CaCO_3$ (mg/L)	*Interim PWQO (µg/L)*
0 - 20	*1*
> 20	*5*

[a] See Section 1.2.3. This Interim PWQO was set for emergency purposes based on the best information readily available. Employ due caution when applying this value.

[b] See Section 1.2.2. This Interim PWQO is currently under development. The value is subject to change upon publication by MOEE.

[1-11] References for criteria development documents - see last page of Table 2.

Cresol, *m*- CAS No. 108-39-4 *o*- CAS No. 95-48-7 *p*- CAS No. 106-44-5	**1 µg/L (Interim PWQO)[b]** • can be applied to all three isomers • common synonym - methylphenol
Cyanide CAS No. 57-12-5	**5 µg/L (PWQO)[1]** • PWQO is for free cyanide in an unfiltered water sample.
Cyclohexanamine CAS No. 108-91-8	**50 µg/L (Interim PWQO)[a]** • common synonym - cyclohexylamine
Cyclohexanol CAS No. 108-93-0	**1000 µg/L (Interim PWQO)[a]**
2,4-D (BEE) CAS No. 1929-73-3	**4 µg/L (PWQO)[1]** • chemical name 2,4-dichlorophenoxyacetic acid - (2-butoxyethyl) ester
Dalapon CAS No. 75-99-0	**110 µg/L (PWQO)[1]**
DDT & metabolites CAS No. 50-29-3	**0.003 µg/L (PWQO)[1]** • PWQO is for the sum of DDT, DDD (CAS No. 72-54-8) and DDE (CAS No. 72-55-9)
Dehydroabietic acid (DHA) CAS No. 1740-19-8	**Interim PWQO[5]: See Resin Acids**
Diazinon CAS No. 333-41-5	**0.08 µg/L (PWQO)[1]**
Dibenzofuran CAS No. 132-64-9	**0.3 µg/L (Interim PWQO)[a]**
Dibenz[a,h]anthracene CAS No. 53-70-3	**0.002 µg/L (Interim PWQO)[a]**
Dibutylamine CAS No. 111-92-2	**8 µg/L (Interim PWQO)[a]**
Dibutylphthalate CAS No. 84-74-2	**4 µg/L (PWQO)[1]** • common synonym - di-*n*-hutylphthalate
Dicamba CAS No. 1918-00-9	**200 µg/L (PWQO)[1]**
Dichlorobenzene, 1,2- CAS No. 95-50-1	**2.5 µg/L (PWQO)[2]**
Dichlorobenzene, 1,3- CAS No. 541-73-1	**2.5 µg/L (PWQO)[2]**

[a] See Section 1.2.3. This Interim PWQO was set for emergency purposes based on the best information readily available. Employ due caution when applying this value.

[b] See Section 1.2.2. This Interim PWQO is currently under development. The value is subject to change upon publication by MOEE.

[1-11] References for criteria development documents - see last page of Table 2.

Dichlorobenzene, 1,4- CAS No. 106-46-7	**4 µg/L (PWQO)[2]**
Dichlorobenzidine, 3,3'- CAS No. 91-94-1	**0.6 µg/L (Interim PWQO)[a]**
Dichlorobut-3-ene, 1,2- CAS No. 760-23-6	**10 µg/L (Interim PWQO)[a]**
Dichloroethane, 1,1- CAS No. 75-34-3	**200 µg/L (Interim PWQO)[6]**
Dichloroethane, 1,2- CAS No. 107-06-2	**100 µg/L (Interim PWQO)[6]**
Dichloroethylene, 1,1- CAS No. 75-35-4	**40 µg/L (Interim PWQO)[6]**
Dichloroethylene, 1,2- CAS No. cis - 156-59-2, trans - 156-60-5	**200 µg/L (Interim PWQO)[6]** • Interim PWQO applies to both the cis & trans 1,2-dichloroethylene.
Dichloroguaiacol, 4,5- CAS No. 2460-49-3	**6 µg/L (Interim PWQO)[a]**
Dichlorophenols CAS No. various	**0.2 µg/L (PWQO)[3]** • PWQO can be applied to all 10 individual isomers: 2,3-, 2,4-, 2,5-, 2,6-, 3,4-, 3,5-, 3,6-, 4,5-, 4,6-, and 5,6-dichlorophenol
Dichloropropane, 1,2- CAS No. 78-87-5	**0.7 µg/L (Interim PWQO)[a]**
Dichloropropylene, trans-1,3 CAS No. 10061-02-6	**7 µg/L (Interim PWQO)[a]**
Dieldrin/Aldrin	**See Aldrin/Dieldrin**
Diethylene glycol CAS No. 111-46-6	**11000 µg/L (Interim PWQO)[a]**
Diethylhexylphthalate CAS No. 117-81-7	**0.6 µg/L (PWQO)[1]**
Diethyl-*m*-toluamide, N,N- CAS No. 134-62-3	**200 µg/L (Interim PWQO)[a]**

[a] See Section 1.2.3. This Interim PWQO was set for emergency purposes based on the best information readily available. Employ due caution when applying this value.

[b] See Section 1.2.2. This Interim PWQO is currently under development. The value is subject to change upon publication by MOEE.

[1-11] References for criteria development documents - see last page of Table 2.

Dimethyl disulphide CAS No. 624-92-0	**0.2 µg/L (Interim PWQO)[a]**
Dimethylamine CAS No. 124-40-3	**3 µg/L (Interim PWQO)[a]**
Dimethylbenzylamine CAS No. 103-83-3	**40 µg/L (Interim PWQO)[a]**
Dimethylformamide, N,N- CAS No. 68-12-2	**5000 µg/L (Interim PWQO)[a]**
Dimethylnaphthalene, 1,3- CAS No. NA	**0.09 µg/L (Interim PWQO)[b]** • When a mixture of dimethylnaphthalenes is found, the most restrictive Interim PWQO of 0.02 µg/L should apply.
Dimethylnaphthalene, 2,6- CAS No. NA	**0.02 µg/L (Interim PWQO)[b]**
Dimethylphenol, 2,4- CAS No. 105-67-9	**10 µg/L (Interim PWQO)[b]**
Dimethylphenol, 2,6- CAS No. 576-26-1	**8 µg/L (Interim PWQO)[b]**
Dimethylphenol, 3,4- CAS No. 95-65-8	**20 µg/L (Interim PWQO)[b]**
Dinitrobenzene, *m*- CAS No. NA	**1 µg/L (Interim PWQO)[b]**
Dinitrobenzene, *o*- CAS No. NA	**1 µg/L (Interim PWQO)[b]**
Dinitrobenzene, *p*- CAS No. NA	**2 µg/L (Interim PWQO)[b]**
Dinitrotoluene, 2,4- CAS No. 121-14-2	**4 µg/L (Interim PWQO)[b]**
Dinitrotoluene, 2,6- CAS No. 606-20-2	**3 µg/L (Interim PWQO)[b]**
Dinitro-*o*-cresol, 4,6- CAS No. 534-52-1	**0.2 µg/L (Interim PWQO)[b]**
Dioxane, 1,4- CAS No. 123-91-1	**20 µg/L (Interim PWQO)[a]**

[a] See Section 1.2.3. This Interim PWQO was set for emergency purposes based on the best information readily available. Employ due caution when applying this value.

[b] See Section 1.2.2. This Interim PWQO is currently under development. The value is subject to change upon publication by MOEE.

[1-11] References for criteria development documents - see last page of Table 2.

Diphenyl ether
CAS No. 101-84-8
0.03 µg/L (Interim PWQO)[a]

Diphenylamine
CAS No. 122-39-4
3 µg/L (Interim PWQO)[a]

Diphenylhydrazine, 1,2-
CAS No. 122-66-7
0.3 µg/L (Interim PWQO)[a]

Diquat
CAS No. 2764-72-9
0.5 µg/L (PWQO)[1]

Dissolved gases
CAS No. NA
PWQO[1]: To protect aquatic organisms, the total dissolved gas concentrations in water should not exceed 110 percent of the saturation value for gases at the existing atmospheric and hydrostatic pressures.

Dissolved oxygen
CAS No. NA
PWQO[1]: Dissolved oxygen concentrations should not be less than the values specified below for cold water biota (e.g. salmonid fish communities) and warm water biota (e.g. centrarchid fish communities):

Dissolved Oxygen Concentration				
Temperature	Cold Water Biota		Warm Water Biota	
°C	% Saturation	mg/L	% Saturation	mg/L
0	54	8	47	7
5	54	7	47	6
10	54	6	47	5
15	54	6	47	5
20	57	5	47	4
25	63	5	48	4

In waters inhabited by sensitive biological communities, or in situations where additional physical or chemical stressors are operating, more stringent criteria may be required. For example, a sensitive species such as lake trout may require more specific water quality objectives.

In some hypolimnetic waters, dissolved oxygen is naturally lower than the concentrations specified in the above table. Such a condition should not be altered by adding oxygen-demanding materials causing a depletion of oxygen.

Diuron
CAS No. 330-54-1
1.6 µg/L (PWQO)[1]

Divinyl benzene
CAS No. 1321-74-0
8 µg/L (Interim PWQO)[a]

Di-*n*-butylamine
CAS No. 111-92-2
8 µg/L (Interim PWQO)[a]

Di-*n*-butyltin
CAS No. 683-18-1
0.08 µg/L (Interim PWQO)[b]

[a] See Section 1.2.3. This Interim PWQO was set for emergency purposes based on the best information readily available. Employ due caution when applying this value.

[b] See Section 1.2.2. This Interim PWQO is currently under development. The value is subject to change upon publication by MOEE.

[1-11] References for criteria development documents - see last page of Table 2.

Di-*t*-butyl-4-methylphenol, 2,6- CAS No. 128-37-0	**0.2 µg/L (Interim PWQO)[a]**
Endosulphan CAS No. 115-29-7	**0.003 µg/L (PWQO)[1]**
Endrin CAS No. 72-20-8	**0.002 µg/L (PWQO)[1]**
Escherichia coli CAS No. NA	**100 *E. coli* per 100 ml** (based on a geometric mean of at least 5 samples) • Based on a recreational water quality guideline published by the Ontario Ministry of Health in 1992. This Ministry of Health guideline was specifically intended for application by the local Medical Officer of Health to swimming and bathing beaches. It is based upon a geometric mean of levels of *E. coli* determined from a minimum of 5 samples per site taken within a given swimming area and collected within a one month period. If the geometric mean *E. coli* level for the sample series at a given site exceeds 100 per 100 mL, the site should be considered unsuitable for swimming and bathing. *E. coli* was selected for the guideline because studies have determined that, among bacteria of the coliform group, *E. coli* is the most suitable and specific indicator of fecal contamination. An analytical test with a high degree of specificity for *E. coli* regardless of water sample source, requiring no confirmation procedures, and which produces results in 21 hours has been developed and adopted by both the Ministry of Health, and Ministry of Environment and Energy laboratories. Where testing indicates sewage or fecal contamination, a site-specific judgement must be made as to the severity of the problem and the appropriate course of action. As of May 1, 1994, MOEE staff have been advised to base all new compliance, enforcement and monitoring activities on the *E. coli* test. Some water managers may find it necessary to continue testing for fecal coliforms or total coliforms. For example, where testing at a long term water quality monitoring station requires a continuous record of results using either the fecal or total coliform test to monitor trends in water quality. As a benchmark for the long term monitoring results, the former objectives for fecal coliforms and total coliforms are referenced for your information. For fecal coliforms the objective was a 100 counts per 100 ml (based on a geometric mean density for a series of water samples). For total coliforms the objective was 1000 counts per 100 ml (based on a geometric mean density for a series of water samples).
Ethanolamine CAS No. 141-43-5	**200 µg/L (Interim PWQO)[a]**
Ethylbenzene CAS No. 100-41-4	**8 µg/L (Interim PWQO)[9]**
Ethylene diamine CAS No. 107-15-3	**0.1 µg/L (Interim PWQO)[a]**
Ethylene dibromide CAS No. 106-93-4	**5 µg/L (Interim PWQO)[a]**
Ethylene glycol CAS No. 107-21-1	**2000 µg/L (Interim PWQO)[a]**

[a] See Section 1.2.3. This Interim PWQO was set for emergency purposes based on the best information readily available. Employ due caution when applying this value.

[b] See Section 1.2.2. This Interim PWQO is currently under development. The value is subject to change upon publication by MOEE.

[1-11] References for criteria development documents - see last page of Table 2.

Ethylene thiourea CAS No. 96-45-7	**60 µg/L (Interim PWQO)[a]**
Eugenol CAS No. 97-53-0	**30 µg/L (Interim PWQO)[a]**
Fenthion CAS No. 55-38-9	**0.006 µg/L (PWQO)[1]**
Fluoranthene CAS No. 206-44-0	**0.0008 µg/L (Interim PWQO)[a]**
Fluorene CAS No. 86-73-7	**0.2 µg/L (Interim PWQO)[a]**
Formaldehyde CAS No. 50-00-0	**0.8 µg/L (Interim PWQO)[a]**
Furfuryl alcohol CAS No. 98-00-0	**1 µg/L (Interim PWQO)[a]**
Guaiacol CAS No. 90-05-1	**1 µg/L (Interim PWQO)[a]**
Guthion CAS No. 86-50-0	**0.005 µg/L (PWQO)[1]**
Heptachlor & Heptachlor epoxide CAS No. 76-44-8	**0.001 µg/L (PWQO)[1]**
Hexachlorobenzene CAS No. 118-74-1	**0.0065 µg/L (PWQO)[2]**
Hexachlorobutadiene CAS No. 87-68-3	**0.009 µg/L (Interim PWQO)[b]**
Hexachlorocyclo-pentadiene CAS No. 77-47-4	**0.07 µg/L (Interim PWQO)[b]**
Hexachloroethane CAS No. 67-72-1	**3 µg/L (Interim PWQO)[b]**
Hydrogen sulphide CAS No. 7783-06-4	**2 µg/L (PWQO)[1]** • undissociated hydrogen sulphide
Hydroxybiphenyl, 2- CAS No. 90-43-7	**6 µg/L (Interim PWQO)[a]**

[a] See Section 1.2.3. This Interim PWQO was set for emergency purposes based on the best information readily available. Employ due caution when applying this value.

[b] See Section 1.2.2. This Interim PWQO is currently under development. The value is subject to change upon publication by MOEE.

[1-11] References for criteria development documents - see last page of Table 2.

Iodine
CAS No. 7553-56-2

100 µg/L (Interim PWQO)[a]

Iron
CAS No. 7439-89-6

300 µg/L (PWQO)[1]

Isopropyl alcohol
CAS No. 67-63-0

300 µg/L (Interim PWQO)[a]

Lead
CAS No. 7439-92-1

PWQO[1]:

Alkalinity as $CaCO_3$ (mg/L)	PWQO (µg/L)
< 20	5
20 to 40	10
40 to 80	20
> 80	25

Lead (revised)
CAS No. 7439-92-1

Interim PWQO[b]: *(See Section 1.10 - Where both a PWQO and an Interim PWQO exist)*

Hardness as $CaCO_3$ (mg/L)	*Interim PWQO (µg/L)*
< 30	*1*
30 to 80	*3*
> 80	*5*

Limonene
CAS No. 138-86-3

4 µg/L (Interim PWQO)[a]

Lindane
CAS No. 58-89-9

0.01 µg/L (PWQO)[1]
- chemical name: gamma - 1,2,3,4,5,6-hexachlorocyclohexane

Malathion
CAS No. 121-75-5

0.1 µg/L (PWQO)[1]

Mercury
CAS No. 7439-97-6

0.2 µg/L (PWQO)[1]
- in a filtered water sample

Methanol
CAS No. 67-56-1

200 µg/L (Interim PWQO)[a]

Methoxychlor
CAS No. 74-43-5

0.04 µg/L (PWQO)[1]

Methyl ethyl ketone
CAS No. 78-93-3

400 µg/L (Interim PWQO)[a]

Methylene chloride
CAS No. 75-09-2

100 µg/L (Interim PWQO)[a]
- common synonym - dichloromethane

[a] See Section 1.2.3. This Interim PWQO was set for emergency purposes based on the best information readily available. Employ due caution when applying this value.

[b] See Section 1.2.2. This Interim PWQO is currently under development. The value is subject to change upon publication by MOEE.

[1-11] References for criteria development documents - see last page of Table 2.

Methylnaphthalene, 1- CAS No. 90-12-0	**2 µg/L (Interim PWQO)[b]**
Methylnaphthalene, 2- CAS No. 91-57-6	**2 µg/L (Interim PWQO)[b]**
Methyl-2-pentanol, 4- CAS No. 108-11-2	**600 µg/L (Interim PWQO)[a]**
Methyl-*t*-butyl ether (MTBE) CAS No. 1634-04-4	**200 µg/L (Interim PWQO)[a]**
Metolachlor CAS No. 51218-45-2	**3 µg/L (Interim PWQO)[a]**
Microbiology CAS No. NA	**See *Escherichia coli***
Mirex (Dechlorane) CAS No. 2385-85-5	**0.001 µg/L (PWQO)[1]**
Molybdenum CAS No. 7439-98-7	**10 µg/L (Interim PWQO)[b]**
Monochlorophenols CAS No. 25167-80-0	**7 µg/L (PWQO)[3]** • PWQO can be applied to all 3 individual isomers: 2-, 3-, and 4-chlorophenol
Monomethylamine CAS No. 74-89-5	**50 µg/L (PWQO)[a]**
Morpholine CAS No. 110-91-8	**4 µg/L (Interim PWQO)[a]**
Naphthalene CAS No. 91-20-3	**7 µg/L (Interim PWQO)[a]**
Nickel CAS No. 7440-02-0	**25 µg/L (PWQO)[1]**
Nitrobenzene CAS No. 98-95-3	**0.02 µg/L (Interim PWQO)[b]**
Nitronaphthalene, 1- CAS No. 86-57-7	**4 µg/L (Interim PWQO)[a]**
Nitrophenol, 2- CAS No. 88-75-5	**0.5 µg/L (Interim PWQO)[b]**
Nitrophenol, 3- CAS No. NA	**20 µg/L (Interim PWQO)[b]**

[a] See Section 1.2.3. This Interim PWQO was set for emergency purposes based on the best information readily available. Employ due caution when applying this value.

[b] See Section 1.2.2. This Interim PWQO is currently under development. The value is subject to change upon publication by MOEE.

[1-11] References for criteria development documents - see last page of Table 2.

Nitrophenol, 4- CAS No. 100-02-7	**50 µg/L (Interim PWQO)[b]**
Nitrosodiphenylamine, N- CAS No. 86-30-6	**7 µg/L (Interim PWQO)[a]**
Nitrosomorpholine, N- CAS No. 59-89-2	**0.9 µg/L (Interim PWQO)[a]**
Nonyl phenol CAS No. 25154-52-3	**0.04 µg/L (Interim PWQO)[a]**
Oil & Grease CAS No. NA	**PWQO[1]:** **Oil or petrochemicals should not be present in concentrations that:** **- can be detected as a visible film, sheen, or discolouration on the surface;** **- can be detected by odour;** **- can cause tainting of edible aquatic organisms;** **- can form deposits on shorelines and bottom sediments that are detectable by sight or odour, or are deleterious to resident aquatic organisms.**
Oleic acid CAS No. 112-80-1	**1 µg/L (Interim PWQO)[a]**
Parathion CAS No. 56-38-2	**0.008 µg/L (PWQO)[1]**
Pentachlorobenzene CAS No. 608-93-5	**0.03 µg/L (PWQO)[2]**
Pentachlorophenol CAS No. 87-86-5	**0.5 µg/L (PWQO)[3]**
Perylene CAS No. 198-55-0	**0.00007 µg/L (Interim PWQO)[a]**
pH CAS No. NA	**PWQO[1]:** **The pH should be maintained within the range of 6.5 - 8.5** **• to protect aquatic life; and** **• both alkaline and acid waters may cause irritation to anyone using the water for recreational purposes.**
Phenanthrene CAS No. 85-01-8	**0.03 µg/L (Interim PWQO)[a]**
Phenol CAS No. 108-95-2	**5 µg/L (Interim PWQO)[b]** • common synonym - monohydroxybenzene
Phenols CAS No. NA	**1 µg/L (PWQO)[1]** • Determined by the total reactive phenols test - the 4-AAP (4-amino-antipyrine) test. • This objective should be used primarily as a screening tool. • The isomer specific PWQOs for various phenolics should be employed where possible.

[a] See Section 1.2.3. This Interim PWQO was set for emergency purposes based on the best information readily available. Employ due caution when applying this value.

[b] See Section 1.2.2. This Interim PWQO is currently under development. The value is subject to change upon publication by MOEE.

[1-11] References for criteria development documents - see last page of Table 2.

Phenylxylylethane CAS No. 6196-95-8	**0.02 µg/L (Interim PWQO)[a]**
Phosphorus, total CAS No. 7723-14-01	**Interim PWQO[1]:** **Current scientific evidence is insufficient to develop a firm Objective at this time. Accordingly, the following phosphorus concentrations should be considered as general guidelines which should be supplemented by site-specific studies:** **To avoid nuisance concentrations of algae in lakes, average total phosphorus concentrations for the ice-free period should not exceed 20 µg/L;** **A high level of protection against aesthetic deterioration will be provided by a total phosphorus concentration for the ice-free period of 10 µg/L or less. This should apply to all lakes naturally below this value;** **Excessive plant growth in rivers and streams should be eliminated at a total phosphorus concentration below 30 µg/L.**
Phthalates, other CAS No. various	**0.2 µg/L (PWQO)[1]** • some other phthalates included are: diethylphthalate (DEP - CAS No. 84-66-2), dimethylphthalate (CAS No. 131-11-3) • see PWQOs for dibutylphthalate and diethylhexylphthalate
Polychlorinated biphenyls (Total PCBs) CAS No. various	**0.001 µg/L (PWQO)[1]** Includes: Aroclor 1016 - (CAS No.) 12674-11-2; Aroclor 1221 - 11104-28-2; Aroclor 1232 - 11141-16-5; Aroclor 1242 - 53469-21-9; Aroclor 1248 - 12672-29-6; Aroclor 1254 - 11097-69-1; Aroclor 1260 - 11096-82-5
Polychlorinated naphthalenes CAS No. various	**0.0002 µg/L (Interim PWQO)[a]**
Propyl diphenyl CAS No. 25640-78-2	**0.1 µg/L (Interim PWQO)[a]**
Propylene glycol, 1,2- CAS No. 57-55-6	**44000 µg/L (Interim PWQO)[a]**
Propylene glycol, 1,3- CAS No. 504-63-2	**10000 µg/L (Interim PWQO)[a]**
Public health considerations	**See *Escherichia coli***
Pyrethrum CAS No. 8003-34-7	**0.01 µg/L (PWQO)[1]**
Quinoline CAS No. 91-22-5	**10 µg/L (Interim PWQO)[a]**

[a] See Section 1.2.3. This Interim PWQO was set for emergency purposes based on the best information readily available. Employ due caution when applying this value.

[b] See Section 1.2.2. This Interim PWQO is currently under development. The value is subject to change upon publication by MOEE.

[1-11] References for criteria development documents - see last page of Table 2.

Radionuclides

CAS No. various

PWQO[8]:

Radiation exposure should be kept as low as reasonably achievable, economic and social factors being taken into account.

The Provincial Water Quality Objectives for radionuclides are based on drinking water requirements, which are derived from dose-response relationships as recommended by the International Commission on Radiological Protection (ICRP) in Publication 26.

The Objectives* are as follows:

Radionuclide**	Provincial Water Quality Objective*** (Becquerels/Litre)
^{137}Cesium	50
^{131}Iodine	10
^{226}Radium	1
^{90}Strontium	10
Tritium	40,000

* **The radionuclide objectives are based on the total concentration in an unfiltered water sample.**

** **If two or more radionuclides affecting the same organ or tissue are found to be present, the following relationship based on ICRP Publication 26 should be satisfied:**

$$\frac{c_1}{C_1} + \frac{c_2}{C_2} + \ldots \frac{c_i}{C_i} \leq 1$$

where c_1, c_2 and c_i are the observed concentrations, and C_1, C_2 and C_i are the maximum acceptable concentrations for each contributing radionuclide.

*** **Radionuclide concentrations that exceed the maximum acceptable concentrations may be tolerated for a short duration, provided that the annual average concentrations remain below this level and meet the restriction for multiple radionuclides.**

Note: For further information on the radionuclide objectives as related to potable water supplies, consult the publication *Ontario Drinking Water Objectives* (Revised, 1994).

Resin Acids (Dehydroabietic Acid and Total Resin Acids)

dehydroabietic acid (DHA) - CAS No. 1740-19-8

Total Resin Acids - includes: abietic acid CAS No. 514-10-3; sandaracopimaric acid CAS No. NA; isopimaric acid CAS No. 5835-26-7; levopimaric acid CAS No. 79-54-9; neoabietic acid CAS No. 471-77-2; palustric acid CAS No. 1945-53-5; pimaric acid CAS No. 127-27-5;

Interim PWQOs[5]:

Interim PWQOs for Dehydroabietic Acid (DHA) and Total Resin Acids are pH dependent as shown below:

	Interim PWQO	
Receiving water pH	DHA (µg/L)	Total Resin Acids (µg/L)
5*	1	1
5.5*	2	3
6*	2	4
6.5	4	9
7	8	25
7.5	12	45
8	13	52
8.5	14	60
9*	14	62

*** - pH is outside the range of the PWQO for pH**

[a] See Section 1.2.3. This Interim PWQO was set for emergency purposes based on the best information readily available. Employ due caution when applying this value.

[b] See Section 1.2.2. This Interim PWQO is currently under development. The value is subject to change upon publication by MOEE.

[1-11] References for criteria development documents - see last page of Table 2.

Selenium CAS No. 7782-49-2	**100 µg/L (PWQO)[1]**
Silver CAS No. 7440-22-4	**0.1 µg/L (PWQO)[1]**
Simazine CAS No. 122-34-9	**10 µg/L (PWQO)[1]**
Styrene CAS No. 100-42-5	**4 µg/L (Interim PWQO)[b]**
Swimming & bathing	**See *Escherichia coli***
Temperature CAS No. NA	**PWQO[1]:** 1) General The natural thermal regime of any body of water shall not be altered so as to impair the quality of the natural environment. In particular, the diversity, distribution and abundance of plant and animal life shall not be significantly changed. 2) Waste Heat Discharge (a) Ambient Temperature Changes The temperature at the edge of a mixing zone shall not exceed the natural ambient water temperature at a representative control location by more than 10C° (18F°). However, in special circumstances, local conditions may require a significantly lower temperature difference than 10C° (18F°). Potential dischargers are to apply to the MOEE for guidance as to the allowable temperature rise for each thermal discharge. This ministry will also specify the nature of the mixing zone and the procedure for the establishment of a representative control location for temperature recording on a case-by-case basis. (b) Discharge Temperature Permitted The maximum temperature of the receiving body of water, at any point in the thermal plume outside a mixing zone, shall not exceed 30°C (86°F) or the temperature of a representative control location plus 10C° (18F°) or the allowed temperature difference, which ever is the lesser temperature. These maximum temperatures are to be measured on a mean daily basis from continuous records. (c) Taking and Discharging of Cooling Water Users of cooling water shall meet both the Objectives for temperature outlined above and the "Procedures for the Taking and Discharge of Cooling Water" as outlined in the MOEE publication *Deriving Receiving-Water Based, Point-Source Effluent Requirements for Ontario Waters* (1994).
Tetrachlorobenzene, 1,2,3,4- CAS No. 634-66-2	**0.1 µg/L (PWQO)[2]**
Tetrachlorobenzene, 1,2,3,5- CAS No. 634-90-2	**0.1 µg/L (PWQO)[2]**

[a] See Section 1.2.3. This Interim PWQO was set for emergency purposes based on the best information readily available. Employ due caution when applying this value.

[b] See Section 1.2.2. This Interim PWQO is currently under development. The value is subject to change upon publication by MOEE.

[1-11] References for criteria development documents - see last page of Table 2.

Tetrachlorobenzene, 1,2,4,5- CAS No. 95-94-3	**0.15 µg/L (PWQO)[2]**
Tetrachloroethane, 1,1,1,2- CAS No. 630-20-6	**20 µg/L (Interim PWQO)[a]**
Tetrachloroethane, 1,1,2,2- CAS No. 79-34-5	**70 µg/L (Interim PWQO)[6]**
Tetrachloroethylene CAS No. 127-18-4	**50 µg/L (Interim PWQO)[6]**
Tetrachloroguaiacol CAS No. 2539-17-5	**0.009 µg/L (Interim PWQO)[a]**
Tetrachlorophenols CAS No. 25167-83-3	**1 µg/L (PWQO)[3]** • PWQO can be applied to 3 individual isomers which were assessed: 2,3,4,5-, 2,3,4,6-, and 2,3,5,6-tetrachlorophenol
Tetraethyl lead CAS No. 78-00-2	**0.0007 µg/L (Interim PWQO)[7]**
Tetramethyl lead CAS No. 75-74-1	**0.006 µg/L (Interim PWQO)[7]**
Thallium CAS No. 7440-28-0	**0.3 µg/L (Interim PWQO)[b]**
Toluene CAS No. 108-88-3	**0.8 µg/L (Interim PWQO)[10]**
Tolyltriazole CAS No. 29385-43-1	**3 µg/L (Interim PWQO)[a]**
Toxaphene CAS No. NA	**0.008 µg/L (PWQO)[1]**
Tributyl phosphate CAS No. 126-73-8	**0.6 µg/L (Interim PWQO)[a]**
Tributyltin CAS No. various	**0.000005 µg/L (Interim PWQO)[b]**
Trichlorobenzene, 1,2,3- CAS No. 87-61-6	**0.9 µg/L (PWQO)[2]**
Trichlorobenzene, 1,2,4- CAS No. 120-82-1	**0.5 µg/L (PWQO)[2]**

[a] See Section 1.2.3. This Interim PWQO was set for emergency purposes based on the best information readily available. Employ due caution when applying this value.

[b] See Section 1.2.2. This Interim PWQO is currently under development. The value is subject to change upon publication by MOEE.

[1-11] References for criteria development documents - see last page of Table 2.

Trichlorobenzene, 1,3,5- CAS No. 108-70-3	**0.65 µg/L (PWQO)[2]**
Trichloroethane, 1,1,1- CAS No. 71-55-6	**10 µg/L (Interim PWQO)[a]**
Trichloroethane, 1,1,2- CAS No. 79-00-5	**800 µg/L (Interim PWQO)[6]**
Trichloroethylene CAS No. 79-01-6	**20 µg/L (Interim PWQO)[6]**
Trichloroguaiacol, 3,4,5- CAS No. 57057-83-7	**0.1 µg/L (Interim PWQO)[a]**
Trichloroguaiacol, 4,5,6- CAS No. 2668-24-8	**0.8 µg/L (Interim PWQO)[a]**
Trichlorophenols CAS No. 108-70-3	**18 µg/L (PWQO)[3]** • PWQO can be applied to all 6 individual isomers: 2,3,4-, 2,3,5-, 2,3,6- 2,4,5-, 2,4,6-, and 3,4,5-trichlorophenol
Triethyl lead CAS No. 1067-14-7	**0.4 µg/L (Interim PWQO)[7]**
Triethyltin CAS No. 994-31-0	**0.4 µg/L (Interim PWQO)[b]**
Trimethylbenzenes CAS No. 25551-13-7	**3 µg/L (Interim PWQO)[a]**
Triphenyltin CAS No. 76-87-9	**0.002 µg/L (Interim PWQO)[b]**
Tungsten CAS No. 7440-33-7	**30 µg/L (Interim PWQO)[a]**
Turbidity CAS No. NA	**PWQO[1]:** **Suspended matter should not be added to surface water in concentrations that will change the natural Secchi disc reading by more than 10 percent.**
Uranium CAS No. 7440-61-1	**5 µg/L (Interim PWQO)[a]**
Vanadium CAS No. 7440-62-2	**7 µg/L (Interim PWQO)[b]**

[a] See Section 1.2.3. This Interim PWQO was set for emergency purposes based on the best information readily available. Employ due caution when applying this value.

[b] See Section 1.2.2. This Interim PWQO is currently under development. The value is subject to change upon publication by MOEE.

[1-11] References for criteria development documents - see last page of Table 2.

Vinyl chloride CAS No. 75-01-4	**400 µg/L (Interim PWQO)[a]** • common synonym - chloroethylene	
Water clarity CAS No. NA	**PWQO[1]:**	**The water in swimming areas should be sufficiently clear to estimate depth or to see submerged swimmers who may require assistance. To achieve this degree of safety, water clarity should be such that, if the bottom of the bathing area is not visible, the water should have a Secchi disc transparency of at least 1.2 m.**
Xylene, *m*- CAS No. 108-38-3	**2 µg/L (Interim PWQO)[b]**	
Xylene, *o*- CAS No. 95-47-6	**40 µg/L (Interim PWQO)[b]**	
Xylene, *p*- CAS No. 106-42-3	**30 µg/L (Interim PWQO)[b]**	
Zinc CAS No. 7440-66-6	**30 µg/L (PWQO)[1]**	
Zinc (revised) *CAS No. 7440-66-6*	***20 µg/L (Interim PWQO)[b]***	*(See Section 1.10 - Where both a PWQO and an Interim PWQO exist)*
Zirconium CAS No. 7440-67-7	**4 µg/L (Interim PWQO)[a]**	

Notes for Table 2:

- All PWQOs are for the for the protection of aquatic life, unless otherwise noted.
- The PWQOs are based on the total concentration of an unfiltered sample, unless otherwise noted.
- The "CAS No." is the number assigned by the American Chemical Society's Chemical Abstracts Services.

REFERENCES FOR TABLE 2

1. MOE. 1979. Rationale for the Establishment of Ontario's Water Quality Objectives. 236 pp.
2. MOE. 1984. Scientific Criteria Document for Standard Development - Chlorinated Benzenes in the Aquatic Environment. 197 pp.
3. MOE. 1984. Scientific Criteria Document for Standard Development - Chlorinated Phenols in the Aquatic Environment. 180 pp.
4. MOE. 1988. Scientific Criteria Document for the Development of Provincial Water Quality Objectives and Guidelines - Aluminum. 81 pp.
5. MOE. 1988. Scientific Criteria Document for the Development of Provincial Water Quality Objectives and Guidelines - Resin Acids. 60 pp.
6. MOEE. 1993. Scientific Criteria Document for the Development of Provincial Water Quality Guidelines for Chlorinated Ethanes & Chlorinated Ethylenes. 111 pp.

[a] See Section 1.2.3. This Interim PWQO was set for emergency purposes based on the best information readily available. Employ due caution when applying this value.

[b] See Section 1.2.2. This Interim PWQO is currently under development. The value is subject to change upon publication by MOEE.

[1-11] References for criteria development documents - see last page of Table 2.

7. MOEE. 1994. Scientific Criteria Document for the Development of Provincial Water Quality Guidelines for Alkylleads. 50 pp.

8. MOEE. 1994. Ontario Drinking Water Objectives (Revised 1994). 68 pp.

9. MOEE. 1994. Scientific Criteria Document for the Development of a Provincial Water Quality Guideline for Ethylbenzene. 32 pp.

10. MOEE. 1994. Scientific Criteria Document for the Development of a Provincial Water Quality Guideline for Toluene. 43 pp.

11. Emerson, K., R.C. Russo, R.E. Lund and R.V. Thurston. 1975. Aqueous ammonia equilibrium calculations: Effect of pH and temperature. J. Fish. Res. Board Can. 32: 2379-2383.

TABLE 3 - Table of Fish Tissue Residue Criteria

The following are fish tissue residue criteria for the protection of fish-consuming birds and also, in the case of mercury, aquatic life. All the criteria are in µg of contaminant per gram of whole-fish (wet weight). Fish tissue residue criteria for the protection of human consumers of sport fish can be found in the publication *Guide to Eating Ontario Sport Fish.*

DDT and Metabolites	The sum of the concentrations of DDT and its metabolites in whole-fish should not exceed 1 µg/g (wet weight basis) for the protection of fish-consuming birds.
Mercury	Concentrations of mercury in whole-fish should not exceed 0.5 µg/g (wet weight basis) for the protection of aquatic life and fish-consuming birds.

REFERENCES FOR TABLE 3

MOE. 1979. Rationale for the Establishment of Ontario's Water Quality Objectives. 236 pp.

MOEE. 1993. Guide to Eating Ontario Sport Fish. 1993-94 edition. Ontario Ministry of Environment and Energy. 171 pp.

APPENDIX B

GROUNDWATER PUBLICATION LIST OF FORMER WATER RESOURCES BRANCH OF THE MOEE

APPENDIX B

SCREENING CHECKLIST TO ACCOMPANY SUBMISSIONS

SCREENING CHECKLIST

FOR HYDROGEOLOGIC STUDIES SUBMITTED IN SUPPORT

OF APPLICATIONS FOR LARGE SUBSURFACE DISPOSAL SYSTEMS,

AND

ON-SITE SUBSURFACE SEWAGE DISPOSAL SYSTEMS IN DESIGNATED AREAS

Project Name: _____

Location: _____
(Lot, Concession No., Municipality)

Ministry File Number: _____

Submitted by: _____

Date: _____

Reviewed by: _____
(Ministry Staff Member)

	Yes	No
Complete Physical Setting Information Provided	—	—
Topographical Maps	—	—
Hydrogeological Maps	—	—
Cross Sections	—	—
Bore Holes	—	—
Description of Hydrogeologic Setting	—	—
Complete Impact Assessment Information Provided	—	—
Most Probable Contaminant Migration Pathway Identified	—	—
Groundwater Usage Information Provided	—	—
Groundwater Impact Assessment Provided	—	—
Surface Water Impact Assessment Provided	—	—

	Yes	No
Are critical contaminants identified and the existing background concentrations established?	—	—
Groundwater Impact Zone(s) Identified	—	—
Information on Auger Holes and/or Test Pits Provided	—	—
Grain-size Analyses Presented for Representative Soil Types?	—	—
Water Budget Information Included	—	—
Estimated Infiltration Rate Included	—	—
Contaminant Loading Calculations and Equations Provided	—	—
Critical Contaminant Concentrations Comply With Policy 15-08	—	—
Monitoring Program and Contingency Plan Provided	—	—
Recommendations and Conclusions Provided	—	—

APPENDIX B

APPROACHES TO SAMPLING

MOE has drafted methodologies for the sampling of air, sediments, soils and lagoons. Regulations 308 details atmospheric emission sampling requirements. Sediment sampling procedures are provided in Guidelines For The Management of Dredged Material In Ontario. These documents may be obtained through local MOE offices or the Waste Management Branch of MOE. The Ministry's Waste Management Branch and Regional staff will review soil, waste pile and lagoon sampling methodologies to ensure they are acceptable.

The sampling requirements of groundwater are site-specific and depend on the nature of the contamination, the dynamics of the aquifer, and the nature of the overburden material. Proposed groundwater sampling programs should be discussed with MOE.

APPENDIX C

MOEE TECHNICAL GUIDELINES

APPENDIX C: MOEE TECHNICAL GUIDELINES

C.1	MOEE GUIDELINE D-5: IMPLEMENTATION GUIDELINE FOR PROVINCIAL POLICY STATEMENT B7: PLANNING FOR SEWAGE AND WATER SERVICES
C.2	TECHNICAL GUIDELINE FOR PRIVATE WELLS: WATER SUPPLY ASSESSMENT
C.3	TECHNICAL GUIDELINE FOR INDIVIDUAL ON-SITE SEWAGE SYSTEMS: WATER QUALITY IMPACT RISK ASSESSMENT
C.4	NOTICE 3/87: PROTECTION OF GROUND WATER QUALITY
C.5	STREAMLINING REGIONAL REVIEWS OF SUBMISSIONS FOR HYDROGEOLOGIC STUDIES SUPPORTING APPLICATIONS FOR LARGE SUBSURFACE DISPOSAL SYSTEMS, AND ON-SITE SUBSURFACE SEWAGE DISPOSAL SYSTEMS IN DESIGNATED AREAS
C.6	STREAMLINING THE APPROVAL OF DISCHARGE CRITERIA TO SURFACE WATER
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C.8	GUIDELINE FOR APPLYING POLICY 15-08 TO LARGE SUBSURFACE DISPOSAL SYSTEMS
C.9	GUIDELINE B-7 (FORMERLY 15-08) THE INCORPORATION OF THE REASONABLE USE CONCEPT INTO THE GROUND WATER MANAGEMENT ACTIVITIES OF THE MINISTRY OF ENVIRONMENT
C.10	PROCEDURE B-7-1 (FORMERLY 15-08)
C.11	GUIDELINE B-1-1 WATER MANAGEMENT POLICIES, GUIDELINES, PROVINCIAL WATER QUALITY OBJECTIVES OF THE MINISTRY OF ENVIRONMENT AND ENERGY
C.12	INTERIM POSITION ON CLEAN-UP OF CONTAMINATED SITES IN ONTARIO
C.13	GUIDELINES FOR THE DECOMMISSIONING AND CLEANUP OF SITES IN ONTARIO

APPENDIX C1

MOEE Guideline D-5 Implementation Guideline For Provincial Policy Statement B7

APPENDIX C

SELECTED PROVINCIAL ENVIRONMENTAL LEGISLATION RELEVANT TO DECOMMISSIONING AND SITE CLEAN-UP

Legislation/Regulation	Topic Covered
Environmental Protection Act (EPA):	
Section 5	Regulated prohibitions on emissions/discharges of contaminants into the environment
Section 6	Control orders related to emissions/discharges
Section 12	Ministry notification when contamination exceeds permitted regulatory levels
Section 13	General prohibitions on emissions/discharges of contaminants that impair the environment
Section 14	Ministry notification when general impairment prohibitions are exceeded
Section 16	Minister's authority to order preventive measures
Section 17	Director's authority to order preventive measures
Section 27	Need for certificate of approval for a waste management system or a waste disposal site
Section 39	Prohibition as to deposit of waste
Section 45	Prohibition on land use of former disposal sites, including those on-site
Section 143	Enforcement of performance of things required to be done

APPENDIX C (cont'd)

Legislation/Regulation	Topic Covered
Regulation 308 under EPA	General - Air Pollution
Regulation 309 under EPA	General - Waste Management
Environmental Assessment Act (EAA):	
Section 14	Approval by Minister to proceed with an undertaking
Section 20	Effect of a decision by the Environmental Assessment Board
Section 29	Minister's authority to exempt undertakings from EAA.
Ontario Water Resources Act (OWRA):	
Section 16	Prohibition on discharge of polluting material
Section 18	Director's authority to require equipment etc. to alleviate effects of impairment of water quality
Section 24	Director's authority with regard to sewage works

NOTES: 1) This table has been prepared for convenience only. For accurate reference, refer to the legislation.

2) Proponents should check with other agencies to establish relevant non-environmental legal requirements.

APPENDIX C2

Technical Guideline For Private Wells: Water Supply Assessment

TECHNICAL GUIDELINE FOR PRIVATE WELLS:

WATER SUPPLY ASSESSMENT

ONTARIO MINISTRY OF ENVIRONMENT AND ENERGY

MARCH 1995

1.0 STATEMENT OF PRINCIPLES

This guideline describes the position of the Ministry of Environment and Energy (MOEE) regarding the assessment of water supplies for developments on individual private wells. The Guideline is based on MOEE experience with development utilising individual wells, and reflects the need to ensure that future owners of lots or homes have a high probability of being able to obtain adequate quantities of potable water for domestic consumption over both the short and long term.

This guideline is presented for use with the understanding that the use of individual private wells has been justified by the municipality or the local planning authority. This justification includes an evaluation of alternative types of servicing. The Province encourages municipalities to plan for environmentally appropriate servicing infrastructures by undertaking comprehensive, large-scale assessment of groundwater and surface water resources (see the Provincial Comprehensive Set of Policy Statements , particularly Policy Statement B7, *Planning for Sewage and Water Services*, and the Implementation Guideline to Policy Statement B7).

MOEE Guideline B-1-1, *Water Management - Policies, Guidelines, Provincial Water Quality Objectives of the Ministry of Environment and Energy*, is made under the authority of the *Ontario Water Resources Act* (OWRA). Guideline B-1-1 deals with the protection and enhancement of drinking water quality and describes the Provincial Water Quality Objectives (PWQOs) and the Ontario Drinking Water Objectives (ODWOs). The primary purpose of Guideline B-1-1 is to protect public health and encourage the provision of aesthetically pleasing water. Water intended for human consumption should not contain any disease-causing organisms or hazardous concentrations of toxic chemicals or radioactive substances. Aesthetic considerations also provide a basis for drinking water objectives since the water should be pleasant to drink.

Although MOEE does not normally review development proposals consisting of five or fewer private residences, the Ministry recommends that supplies serving five or fewer private residences should use the ODWOs to ensure the quality of drinking water.[1] This recommendation may apply to development by consent or at the official plan amendment stage in certain areas; contact the local MOEE Regional office for further information.

The Ontario Water Resources Act, RSO 1990, obliges the MOEE to comment on the quality of private water supplies which are part of development proposals submitted to the MOEE for review.

Ontario Regulation 903 establishes standards and regulations concerning well construction.

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[1] See "Ontario Drinking Water Objectives", Ontario Ministry of the Environment and Energy.

With respect to proposals involving individual on-site sewage systems (subsurface sewage systems), a separate guideline for the assessment of the impact of such systems on adjacent lands is available from the MOEE office in your Region. The title of the Guideline is *Technical Guideline for Individual On-site Sewage Systems: Water Quality Impact Risk Assessment.*

With respect to communal water supply systems to serve more than five private residences, a Certificate of Approval, and possibly a Permit to Take Water will be required. For communal sewage systems, a Certificate of Approval will be required. For more information on communal systems, please contact the MOEE office in your area.

2.0 OBJECTIVES

The objectives of this guideline are as follows:

- to provide technical guidance to professionals involved in land development (in particular, hydrogeologists) in the assessment of groundwater quality and quantity;
- to provide an interpretation of the application of MOEE policy to development of individual private well water supplies; and
- to ensure that development proposals are submitted with the required technical support.

3.0 APPLICATION

The guideline applies to all development proposals for residential development involving individual well water supplies. Development agreements between the proponent and the municipality, or its equivalent in unorganised areas, shall be used to bind development to the recommendations of approved hydrogeology studies.

The guideline also applies to developments for which a plan of condominium is required and to industrial, commercial or institutional developments where water is used for human consumption. Please contact your regional MOEE office for information on the applicability of the guideline to a particular development of this type.

4.0 INFORMATION REQUIREMENTS

4.1 General

A hydrogeological study will be required by MOEE prior to recommendation of draft approval for plans of subdivision and condominium, and may be required prior to approval of official plan amendments which would permit development on private services. The study must be performed and a report submitted to the MOEE at the time of circulation of the proposed official plan amendment or plan of subdivision. The report must address concerns relative to the following:

- Future residents must be provided with water for domestic consumption that is of acceptable quality and of adequate quantity.

- Appropriate well construction techniques must be followed in order to minimise the possibility of well water quality degradation.

- There must be minimal adverse effects on well water in the development from sources of contamination on the site or on adjoining lands.

- Developments must not result in water quantity interference conflicts between users in the development and users on the adjoining lands.

With respect to **quality**, each future domestic well must provide water that is safe and aesthetically suitable for human consumption. The suitability of the water for domestic use is determined by comparing the results of the analysis of ground water samples from test wells with the applicable ODWOs (see Section 4.4 and the Appendix).

With respect to **quantity**, each future domestic well must provide sufficient water for normal domestic purposes (see Section 4.3 "Well Water Quantity Testing"). This will be determined mainly on the basis of data from pumping tests in test wells.

After its initial review of a hydrogeological study report, the MOEE may advise the consultant and the proponent that additional information be supplied, or recommend that further work be done. The advice and recommendations must not be construed as conditions of approval but rather as suggestions for those cases where the proponent wishes to continue to pursue approval. Ultimately, it is the hydrogeology of the site itself which will determine whether a proposal is acceptable.

When a report is found to be incomplete, draft or preliminary, or makes unsubstantiated claims, the MOEE will advise the proponent by letter with regard to the report's deficiencies. The MOEE may not undertake a full review until such time that a complete report (i.e., one which satisfies the requirements of this Guideline) has been submitted.

4.2 Test Well Requirements

Site assessment for water supplies from wells must be undertaken as follows:

i) The minimum number of test wells will be:

- 3 for sites up to 15 hectares in area;
- 4 for more than 15 and up to 25 hectares;
- 5 for more than 25 and up to 40 hectares;
- for more than 40 hectares, one additional test well for each additional 20 hectares or portion thereof.

Where development by severance is considered, determination of the availability of a potable water supply should be made as early as possible in the severance approval process.

In areas where groundwater quantity or quality are considered marginal with respect to domestic requirements, as many as one test well per lot may be required;

ii) The areal distribution of test wells must be such that hydrogeological conditions across the site are adequately represented. Depending on the areal configuration and hydrogeological complexity of the site, more than the minimum number referred to in section i) may be required;

iii) Consideration must be given to past or present land uses. Existing improperly abandoned wells should be identified since they may impact on ground water. Moreover, any contaminant spills on or adjacent to the site which may affect water quantity or quality should be identified and evaluated for their impact on groundwater.

The test well(s) should be located in an area which would permit a proper assessment of these impacts;

iv) Test wells must be located and constructed in such a way as to permit the prediction of the quantity and quality of groundwater which domestic wells will supply in the future. Accordingly, the construction of these wells must be typical of wells which will be used in the development in the future, and must comply with *Ontario Regulation 903*, with the requirements of other jurisdictions, and with any additional specifications recommended by the consultant and/or MOEE.

Existing water wells located on the site or in the immediate proximity of the site may be used as test wells, provided they fulfil i) to iv) above, and are fully incorporated into the well water quantity and quality testing programs described in the sections below. The use of existing wells and of the data obtained from them **must** be justified in the report as being technically appropriate; however, there must be at least one test well, new or existing, located on the site.

If the consultant and licensed well contractor properly locate and construct the test wells, or if there are pre-existing wells on the property which meet the requirements of iv) above, the developer may use them later as domestic water wells. They must, however, yield potable water and meet the construction requirements indicated in the approved study recommendations, which are implemented by provisions in the development agreement between the municipality (or its administrative equivalent) and the proponent. If any such wells are not to be maintained for future use, they must be properly abandoned as required by *Ontario Regulation 903*; abandonment must be recommended in the hydrogeological study report and must be implemented by the development agreement. To ensure that the recommendations of the report are properly implemented, the consultant's report may include recommendations for supervision of well construction by a qualified consultant at the time the well is being constructed by the (licensed) well contractor.

4.3 Well Water Quantity Testing

Each of the test wells must be subjected to a pumping test. The tests may be done sequentially, using the other wells as observation wel¹s, or several wells could be pumped simultaneously. The report must contain all well logs, Water Well Records, raw pumping test data and graphs, and hydrogeological cross section(s), and must discuss the sustainability of domestic well yields, the potential for supply interference and site aquifer characteristics such as hydraulic gradient, transmissivity and boundary conditions. (Note that in most cases where on-site sewage systems are proposed, the impact assessment requires a determination of the hydraulic gradient.)

4.3.1 Pump Test Procedure

The following pumping test procedure is recommended:

- the test wells should be fully developed prior to the pumping test in order to avoid unacceptable turbidity levels at the time of sampling;

- the pumping test must begin with a static water level and must be performed at a fixed rate (±5%) for a minimum period of six hours[2] (longer where supplementary storage systems are necessary) of "continuous" pumping (no stoppages); water levels must be monitored in the test well and observation wells at an appropriate frequency; water must be discharged at an appropriate distance from the test wells to ensure that artificial recharge does not occur;

- immediately following the pumping test, water level recovery must be monitored in the test wells until 95% recovery occurs or for 24 hours, whichever is less; where sufficient recovery does not occur, the issue of the long-term safe yield of the aquifer is especially significant and must be addressed; and

- the test rate will be at least the minimum rate discussed below (also see Section 4.4.1.).

4.3.2 Calculation of Minimum Test Rate and Well Yield

The minimum pumping test rate and well yield required for a particular development must be calculated as follows:

The per-person requirement shall be 450 litres per day. Peak demand occurs for a period of 120 minutes each day[3]. This is equivalent to a peak demand rate of 3.75 litres/minute for each person. The basic minimum pumping test rate is this rate multiplied by the "likely number of persons per well" which, for a single family residence, shall be the number of bedrooms plus one. Unless it is otherwise established to MOEE's satisfaction, a ***minimum*** of four bedrooms shall be used in the calculation. However, regardless of the results of this calculation, this rate shall not be less than 13.7 litres /minute.

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[2] The minimum duration of six continuous hours incorporates safety factors with respect to seasonal variables.

[3] Refer to page 5 of the MOEE publication entitled *"Water Wells & Ground Water Supplies in Ontario"*, 1989. The per-person daily demand used here is the upper limit of the estimated range.

The only instance where rates lower than these may be used is where preliminary results indicate that the pumping test rate cannot be sustained in the long term, and consideration is given to systems which would compensate for low well yields. In this case, the rate of test pumping may be decreased, but the duration must be proportionately increased such that the total amount pumped equals the amount that would have been pumped if the test had been conducted using the procedures and minima discussed above. The yield requirement must then be applied to the well and to the compensatory system on a daily basis. These systems and any special water treatment devices that may be necessary for their proper functioning must be fully described in the report.

Regardless of whether systems to compensate for low yields are required, the report must demonstrate that future domestic wells will sustain repeated pumping at the test rate and duration at 24-hour intervals over the long-term.

Where a test well can safely provide water at the calculated rate, it is not acceptable to conduct pumping tests at low rates and subsequently recommend the use of systems to compensate for low well yields simply in order to limit the migration of poorer quality water into the well.

Consultants must provide a statement indicating that, in their professional opinion, the probable well yields determined on the basis of their investigations are representative of the yields which residents of the development are likely to obtain from their wells in the long term.

4.3.3 Additional Information

Shallow wells and unconfined aquifers are susceptible to seasonal fluctuations in water level. In these cases, the consultant must address this issue and may need to perform additional investigations to determine the possibility of future well water quantity problems.

Groundwater heat pumps which do not return water to the aquifer of origin are not permitted. If treatment systems which require additional amounts of water for their operation are to be used, those rates must be added.

Consultants should address the issue of whether the groundwater withdrawals in the proposed development and in other existing or planned developments in the area will exceed the long-term safe yield of the aquifer, or significantly decrease baseflow to sensitive water courses (trout streams, etc.). Relevant information may be available from the local planning authority, other ministries and agencies, municipal offices, and local residents.

Where there is established development in the vicinity, information from residents and other sources regarding well yield problems (water shortages, replacement wells etc.) should be obtained.

4.4 Well Water Quality Testing

4.4.1 Raw Water Quality

The consultant must obtain and analyse sufficient water quality samples during each pumping test in order to determine the physical, chemical and bacteriological quality of the water. At least one of these samples must be collected during the last hour of the test. It is the consultant's responsibility to address water quality changes over time and to demonstrate that the water quality data are representative of the quality of water which future residents can expect in the long term.

Prior to any testing for water quality, there must be no chlorine residual. Chlorine residual tests must be performed at the well head at the time that bacteriological samples are obtained, and must be reported.

Where there are wells in nearby established developments, information should be obtained from residents, where possible, and other sources regarding water quality problems. If on-site sewage systems are used in the existing development(s) and are also to be used in the proposed development, well water samples from the existing development should be obtained and analysed. The consultant should use this information to predict the impact of the proposed on-site sewage systems on water quality within the proposed development.

Water quality may vary between aquifers or with depth in the same aquifer. The consultant should recommend appropriate well construction (see Section 4.5) and must comment on the potential for cross-contamination between aquifers.

Shallow and/or unconfined aquifers are susceptible to contamination from sources located at or near the ground surface. If wells are to be constructed within such aquifers, and especially where individual on-site sewage systems are also proposed, the consultant must address the risk of contamination and recommend measures which will reduce that risk.

The minimum set of parameters for which the analyses must be performed is listed in the Appendix, along with the applicable Ontario Drinking Water Objectives. Other parameters, such as heavy metals, pesticides, tannins, sulphide, phenols, and fluoride, may be required by the Regional MOEE office in your area. Please contact the office for more information. The consultant must also determine whether conditions specific to the site or its surrounding area require the inclusion of additional parameters. Complete documentation of sampling times, any on-site analytical methods, and all analytical results must also be included in the report.

If methane or other potentially explosive gases are encountered during the water supply assessment, the consultant must make recommendations to adequately control this hazard.

Note: Where health-related ODWOs or treatment limits for aesthetic ODWOs have been exceeded, the areas which the relevant test wells represent may have to be excluded from the proposed development site. In this case a justification for the selection of the boundary of the site is required.

4.4.2 Treatment Systems

For some aesthetic parameters, the ODWOs may be exceeded provided that concentrations are below the treatment limits noted in Table 3. The Appendix lists these parameters, the limits for treatment and some comments on treatment methods. In cases where raw water sodium levels exceed 20 mg/L, warning clauses should be addressed to people on sodium restricted diets and should be registered on title. In addition, if water softening is utilised to reduce hardness, a warning should be registered on the title with a recommendation that a separate tap, which by-passes the softener, be installed to supply unsoftened drinking water.

If the raw water from the wells exhibits values for aesthetic parameters that are above the ODWOs but below the treatment limits, or if supplemental storage systems are proposed which require special treatment systems, the municipality's assent to development based on treatment systems must be obtained in the form of a Resolution of Council, prior to MOEE recommending draft approval (see Section 5.0 Implementation).

If treatment is required, "Comments on Treatment" listed in Table 3 of the Appendix are provided for the purpose of assisting applicants and municipalities in deciding whether development based on treatment systems should proceed. Prior to the municipality considering approval of the development proposal and/or Official Plan Amendment, it is the applicant's responsibility, based on advice from a qualified consultant, to satisfy the municipality that the concept of using treatment systems is appropriate. MOEE staff will not comment on the acceptability of the various proprietary treatment systems available.

The treatment systems mentioned in Table 3 of the Appendix are suggested for treatment for single parameters. When treatment for more than one parameter is required, the systems suggested may not be appropriate due to treatment process interferences. The consultant must supply recommendations regarding the type of treatment required.

4.5 Well Construction

Construction specifications for future domestic wells in the proposed development must be addressed by the consultant in the hydrogeological report. Minimally, the construction of both the test wells and future domestic wells must comply with Ontario Regulation 903 made under the *Ontario Water Resources Act*, and with municipal requirements - where applicable.

When on-site sewage systems are proposed, or when they already exist on adjacent property, protection of the wells from contamination by effluent must be addressed.

When shallow and/or unconfined aquifers are to be used, the consultant must recommend construction specifications and well locations to address the issue of the susceptibility of such aquifers to contamination from sources at or near the ground surface.

Water quality may vary between aquifers or with depth in the same aquifer. The consultant should recommend appropriate well construction, methods and requirements, and must comment on the potential for cross-contamination between aquifers.

The consultant or the MOEE may wish to recommend additional site-specific construction criteria and/or supervision of well construction by qualified staff. In studies in which the consultant's **initial** findings show that water quality or quantity standards cannot be met without special well construction specifications, the initial data which led to these conclusions must be included in the report. The structure of the test wells on which the **final** quantity and quality data are based must meet these specifications and the wells must be tested according to the procedures stipulated in this Guideline, in order for the data to be deemed representative.

Subsections 13(2) and 13(3) of *Ontario Regulation 903* require that wells be constructed such that the casing of a drilled well protrudes at least 30 centimetres above ground surface or above the floor of a well pit. Well water contamination caused by the entry at the well head of water originating at or near the surface may occur if the well head is buried. Subsection 20(3) requires that the well owner maintain the well in a manner sufficient to prevent such contamination. Where well heads are buried, locating, inspecting and servicing the well are difficult and expensive.

Subsections 13(2), 13(3) and 20(3) are often contravened when, after a well is constructed, contractors or residents bury the well head for reasons of convenience or aesthetics. Contractors and residents should be reminded of the intent and requirements of these portions of the Regulation, and of their responsibility to ensure that the finished grade of the ground surface allows the casing to protrude the required distance. This is necessary to prevent ponding at the well head or, in the case of well pits, prevents flooding of the pit. Where flowing well conditions occur, the requirements of Regulation 903 must be met.

4.6 Land and Water Use Conflicts

Land uses within a minimum of 500 m of the site must be described. Where wells exist on or adjacent to the site, a survey of well owners, and sampling and analysis of representative well water, should be performed and reported. The potential for an adverse impact on the development must be addressed, when there have been, are, or may in the foreseeable future be significant potential sources of groundwater contamination (e.g., from old, operating or proposed waste disposal sites, road salt storage facilities, farming activities, locations of contaminant spills, etc.), or potential causes of quantity interference with groundwater resources or well water supplies (e.g., from municipal wells, dewatering activities, etc.) within a minimum of 500 metres of the site. The issue of whether additional water quality parameters should be included in the testing must also be addressed.

4.7 Phased Developments

Where a development application relates to an **additional** phase of a phased development, even though previous phases may already have been approved on the basis of previous hydrogeological studies which encompassed those phases or the entire site, a supplementary study and report is required. Water samples from wells that are located on nearby developed lots in previous phases that are in use and representative of the same formation, must be analysed for the required parameters, and the well owners should be interviewed (where possible) regarding their experience with their well water quantity and quality. This information, as well as the Water Well Records and a map showing the locations of all wells in previous phases, must be provided. The original hydrogeological report must be re-assessed in light of the new information obtained and according to any **new** criteria or guidelines which may not have been in effect at the time of the original study. Where well water quality or well yield in the previous phases are not comparable to that found in the original test wells or predicted by the original hydrogeological study, the new study should investigate and explain the causes and provide new recommendations based on a re-assessment of the original report. Where new guidelines require information which is not included in the original report, the new report must provide it.

If the new phase does not contain test wells from the original study, new ones must be installed. Where additional study involving new test wells is necessary, most or all of the criteria set forth in this Guideline will apply. Consultants should discuss these issues with MOEE staff before proceeding.

5.0 IMPLEMENTATION

MOEE staff will implement this guideline through comments and advice supplied to municipalities, the public, and approval authorities on documents circulated under the *Planning Act.*

It should be noted that the MOEE will not recommend approval for official plan amendments and draft plans of subdivision or condominium unless the MOEE (or its agents) is satisfied that the hydrogeological report demonstrates that sufficient water is available. Where groundwater of adequate quality and quantity is demonstrated to be available to service the proposed development, the MOEE will require, as a condition of final approval, that the MOEE receive a copy of a fully executed subdivision or condominium agreement or other suitable development agreement between the municipality and the developer, which requires that the recommendations of the hydrogeological report as approved by the MOEE (or its agents) be implemented. The municipality should ensure that MOEE comments have been adequately addressed within the fully executed agreement.

If groundwater open loop heat pumps are being considered for use in the proposed development, they must be included in the hydrogeological study to ensure that domestic potable water supplies will not be adversely impacted. If the issue of groundwater heat pumps is not addressed in the report, MOEE will request that a condition be placed in the development agreement indicating that the use of groundwater heat pumps has not been approved as part of the development.

The possibility of using systems to compensate for low well yields (for example, controlled pumping to supplementary storage) is discussed earlier in this Guideline. However, while the MOEE may provide technical guidance, it is the municipality's responsibility to decide whether development on the basis of such systems should be allowed. If the municipality agrees to their use, notification must be given through the development agreement between the municipality and the proponent(s). The municipality shares responsibility with the proponent(s) for ensuring that the terms of the development agreement are completed.

With respect to water **quality**, the following will apply (except for the 20 mg/L warning level for sodium):

- Where health and aesthetic ODWO criteria are met, MOEE will comment favourably on approval of the Official Plan Amendment or on draft approval of the Plan of Subdivision or Condominium.

- Where health-related ODWO criteria are **not** met, MOEE will recommend **against** approval of the proposal on the basis of individual wells.

- Where health-related ODWO criteria are met **but** aesthetic objectives are exceeded, it may be possible to use in-home water treatment systems to reduce the values of the aesthetic parameter(s) concentrations to a level below the limits, and thereby meet the objectives.

This guideline lists concentrations considered treatable for several aesthetic parameters and some possible treatment systems (see Table 3 of the Appendix). However, it is the municipality's responsibility to decide whether development on the basis of in-home treatment systems should be permitted. Following MOEE's review of a study which includes recommendations for such treatment, MOEE will notify the municipality (or its equivalent), the proponent, and the consultant that MOEE will only recommend draft approval following receipt of a Resolution of Council. The Resolution must advise that the municipality concurs with development based on use of these systems. The development agreement between the municipality and the proponent shall contain provisions for implementation of the recommendations, including treatment, in the approved hydrogeology study. The municipality shares responsibility with the proponent for ensuring that the terms of the development agreement are carried out.

Where health objectives are exceeded or where treatment limits for aesthetic objectives are exceeded, the local municipality and the approving authority should only consider development on the basis of a communal water system. MOEE approvals are required for Water Works for municipal and communal systems, as defined under the *Ontario Water Resources Act* and set out in MOEE Guideline B-14, *Treatment Requirements for Municipal and Communal Water Works Using Groundwater Sources*. The municipality shall assume ownership of and responsibility for the water works following completion.

6.0 DEFINITION

Individual wells:

Private water wells supplying five or fewer residences (or the equivalent for other types of development) are referred to in this guideline as "individual wells".

7.0 REFERENCE DOCUMENTS

Other documents that should be used in conjunction with this Guideline include:

- "Comprehensive Set of Policy Statements", Province of Ontario;

  - Policy Statement B7, "Planning For Sewage and Water Services", Ontario Ministry of Environment and Energy (MOEE);

  - Policy Statements B8 through B11, "Growth and Settlement", Ontario Ministry of Municipal Affairs, (MMA).

- "Implementation Guidelines to the Comprehensive Set of Policy Statements", Province of Ontario

  - Implementation Guideline to Policy Statement B7, "Planning For Sewage and Water Services", Ontario Ministry of Environment and Energy (MOEE);

  - Implementation Guideline to Policy Statements B8 through B11, "Growth and Settlement", Ontario Ministry of Municipal Affairs, (MMA).

- "Technical Guideline for Individual On-Site Systems: Water Quality Impact Risk Assessment", MOEE.

- "Water Management - Policies, Guidelines, Provincial Water Quality Objectives of the Ministry of Environment and Energy", MOEE Guideline B-1-1 (July 1994).

- Ontario Water Resources Act, RSO 1990.

- "Water Wells & Ground Water Supplies in Ontario", MOEE 1989.

- Regulation 903, made under the Ontario Water Resources Act.

- "Levels of Treatment for Municipal and Private Sewage Treatment Works Discharging to Surface Waters", MOEE Guideline F-5.

- "Treatment Requirements for Municipal and Communal Water Works Using Groundwater Sources", MOEE Guideline B-14.

APPENDIX

GROUNDWATER QUALITY PARAMETER TABLES

Published documents have been the main source of information regarding the water quality limits appearing in the tables below. Additional parameters may be required by the Regional MOEE office in your area. Also, when new water quality limits are formally instituted by the relevant authority, this guideline will be updated and an effort will be made to distribute the new requirements to interested parties. However, IT IS THE RESPONSIBILITY OF THE CONSULTANT TO APPLY THOSE CRITERIA WHICH ARE APPROPRIATE AT THE TIME THE STUDY IS PERFORMED AND REPORTED. It is, therefore, highly recommended that consultants maintain regular contact with the MOEE.

TABLE 1: HEALTH-RELATED BACTERIOLOGICAL PARAMETERS

PARAMETER	Ontario Drinking Water Objective (See Note 1)	COMMENTS
Escherichia coli	0	Indicators of contamination
Fecal coliforms	0	
Total coliforms	0	Indicator of possible or potential contamination

1. These are expressed as the plate count per 100 ml of sample. Every bacteriological sample must be submitted for analyses for all the above and the lab reports must be accompanied by a report of the chlorine residual as measured at the time of sampling.

   Exceedances must be explained and any re-sampling must be fully documented with respect to chlorine residual, rates and duration of pumping, etc.

   While the stated ODWO for Total Coliform is 0 counts per 100 ml of sample, it is recognized that the objective has been set as an indicator of inadequate disinfection within the distribution systems associated with water works. For private water wells not subject to approval under the OWRA, the MOEE and Health Units have historically used the limit of <5 counts per 100 ml in the absence of a chlorine residual as indicating acceptable water quality. For the purposes of the assessment described by this Guideline, Total Coliform counts of less than 6 per 100 ml of sample (and 0 for E. coli and fecal coliforms) shall be considered as indicative of acceptable water quality.
   The chlorine residual must be zero before any bacteriological sample can be taken.

TABLE 2: HEALTH-RELATED CHEMICAL AND PHYSICAL PARAMETERS

PARAMETER	Ontario Drinking Water Objective (See Note 2)	COMMENTS
Nitrate (as N)	10.0 mg/L	contamination indicator; exceedance may be dangerous to infants and others
Nitrite (as N)	1.0 mg/L	contamination indicator
Nitrate plus Nitrite (as N)	10.0 mg/L	contamination indicators
Sodium	20 mg/L (see note 3)	levels may be significant for persons with medical conditions requiring low-salt diets
Turbidity	1 NTU or 1 FTU (see note 4)	could indicate problems in well construction or a naturally occurring problem; may interfere with water treatment
Other parameters	(see note 5)	

2. Except for sodium, the Ontario Drinking Water Objective for parameters in Table 2 are Maximum Acceptable Concentrations under the Ontario Drinking Water Objectives. Units of measure and, where required, conversion factors must be provided. For more information on the Objectives, refer to the MOEE publication entitled "Ontario Drinking Water Objectives".

3. This health-related limit is a "warning level" only. Exceedance calls for a recommendation that the local Medical Officer of Health be notified in order to alert persons with relevant medical conditions. Sodium also has an Aesthetic Objective of 200 mg/L (see Table 3).

   If water softening is used, a separate tap supplying unsoftened water should be used for drinking purposes.

4. NTU = Nephelometric turbidity unit; FTU = Formazin turbidity unit. These terms are interchangeable. NTU is the term used in the ODWOs. For the purposes of this guideline, the consultant must note that if turbidity is present, particular care must be taken during testing to ensure that the bacteria requirements of Table 1 are met.

5. See also section 5.5.1: "Raw Water Quality", above, regarding the responsibilities of the proponent or consultant to add parameters where necessary; the consultant must also provide the relevant information on any drinking water quality limits, including those from other jurisdictions.

TABLE 3: COMMON AESTHETIC, ANALYTICAL AND INDICATOR PARAMETERS

Parameter	General Comments	Ontario Drinking Water Objective (see note 6)	Maximum Concentration considered reasonably treatable	Comments on Treatment
Alkalinity	useful analytical parameter	-	-	-
Ammonia	contamination indicators	-	-	-
Background Bacteria				
Calcium	see Hardness	-	-	-
Chloride	associated with salt problems	250 mg/L	250 mg/L	not considered reasonably treatable above the limit
Colour	associated with certain metals and organic substances	5 TCU (True Colour Units)	7 TCU	carbon filter treatment systems (see note 7)
Conductivity	useful analytical parameter	-	-	-
DOC (Dissolved Organic Carbon)	taste, odour, colour, turbidity, precursor for harmful contaminants after chlorination	5.0 mg/L (as C)	10.0 mg/L (as C)	carbon filter treatment systems

Parameter	General Comments	Ontario Drinking Water Objective (see note 5)	Maximum Concentration considered reasonably treatable	Comments on Treatment
rdness	taste, encrustation and reaction with soap	500 mg/L as $CaCO_3$ (see note 7)	-	water softener (see note 8)
n	may cause staining of plumbing fixtures and laundry	0.3 mg/L	up to 5.0 mg/L	water softeners or manganese greensand filters
			5.0 to 10.0 mg/L	oxidation with filtration through proprietary filter media or chlorination followed by sand or multimedia filtration
gnesium	see Hardness	-	-	-
nganese	may cause staining of plumbing fixtures and laundry	0.05 mg/L	1.0 mg/L	water softeners or manganese greensand filters
	associated with corrosion or encrustation or contamination by other substances	6.5 - 8.5	-	-
ium	taste	200 mg/L (see note 9)	200 mg/L	not considered reasonably treatable above the limit
hate	laxative	500 mg/L	500 mg/L	not considered reasonably treatable above the limit

Parameter	General Comments	Ontario Drinking Water Objective (see note 6)	Maximum Concentration considered reasonably treatable	Comments on Treatment
TDS (Total Dissolved Solids)	corrosion or encrustation of metal fixtures or appliances; taste; must be measured independently of Conductivity; turbidity	500 mg/L	-	requires written rationale that corrosion, encrustation or taste problems will not occur
Turbidity	5 NTU or 5 FTU (see Note 10)	5 NTU or 5 FTU	5 NTU or 5 FTU	-
Other parameters	(see note 11)	-	-	-

6. Except for hardness, the drinking water quality limits in Table 3 are Aesthetic Objectives under the Ontario Drinking Water Objectives. Units of measure and, where required, conversion factors must be provided. For more information on the Objectives, refer to the MOEE publication entitled "Ontario Drinking Water Objectives".

7 Higher, iron-related colour may be removed by manganese greensand treatment; however, the nature of the constituents causing excessive colour must be determined. See section 4.4.2: "Treatment Systems", above.

8. Generally, water with a hardness value of more than 300 mg/l is considered "very hard". The Ontario Ministry of the Environment publication entitled "Ontario Drinking Water Objectives", states that waters with hardness "in excess of 500 mg/l are unacceptable for most domestic purposes". A maximum treatable value is not available.

9. Sodium also has a health-related "warning level" of 20 mg/l (see Table 2). Since water softening results in high sodium levels, a separate tap, which supplies unsoftened water, should be installed for drinking purposes.

10. For the purposes of this guideline, the consultant must note that if turbidity is present, particular care must be taken during testing to ensure that the bacteria requirements of Table 1 are met.

11. See also section 4.4.1: "Raw Water Quality", above, regarding the responsibilities of the proponent or consultant to add parameters where necessary; the consultant must also provide the

APPENDIX C3

Technical Guideline For Individual On-Site Sewage Systems: Water Quality Impact Risk Assessment

TECHNICAL GUIDELINE

FOR

INDIVIDUAL ON-SITE SEWAGE SYSTEMS:

WATER QUALITY IMPACT RISK ASSESSMENT

ONTARIO MINISTRY OF ENVIRONMENT AND ENERGY

MARCH 1995

1.0 STATEMENT OF PRINCIPLES

This guideline describes the position and requirements of the Ministry of Environment and Energy (MOEE) regarding the assessment of the potential impact on groundwater caused by proposed developments on individual on-site sewage systems (sub-surface sewage systems). This guideline applies only to those areas of the Province which have not been designated under Notice 3/87 (attached) as subject to MOEE Guideline B-7, *Incorporation of The Reasonable Use Concept into MOEE Groundwater Management Activities* (formerly MOEE Policy 15-08). In areas so designated, the proposed development must comply with the requirements of MOEE Guideline B-7 and its associated guidelines.

The guideline reflects the Ministry's experience with development utilising individual on-site sewage systems, and emphasises the need to minimise the potential for adverse groundwater impacts resulting from their use.

This guideline is presented with the understanding that the use of individual on-site sewage systems has been justified by the municipality or the local planning authority. This justification includes an evaluation of alternative types of servicing. The Province encourages municipalities to plan for environmentally appropriate servicing infrastructures by undertaking comprehensive, large-scale assessment of groundwater and surface water resources (see the Provincial Comprehensive Set of Policy Statements, particularly Policy Statement B7, *Planning for Sewage and Water Services*, and the Implementation Guideline to Policy Statement B7).

The purpose of this guideline is to protect the environment and public health by ensuring that development utilising individual on-site sewage systems proceeds at a density and scale which will not result in, or cause degradation of, groundwater resources in exceedance of acceptable limits. Compliance with acceptable limits shall be demonstrated through a prediction of the development's nitrate impact on the groundwater at the development boundary. The Guideline is intended to encourage the assessment of the potential for degradation on the basis of a technically based and technically defensible evaluation of the proposal.

2.0 OBJECTIVES

The objectives of this guideline are as follows:

a) To provide technical guidance to professionals involved in land development (in particular, hydrogeologists) in assessing the potential for unacceptable groundwater impacts resulting from the use of individual on-site sewage systems, through a three stage assessment process.

b) To ensure that proposals are submitted with the required technical support to allow the Director to either support the proposed development, designate the proposed development under Notice 3/87 (thus requiring an assessment in compliance with MOEE Guideline B-7 and its associated guidelines), or to recommend against approval.

3.0 APPLICATION OF THE GUIDELINE

This guideline applies to the combined or total impact on groundwater of a development proposal of more than five units with individual on-site sewage systems, in areas which have **not** been designated under Notice 3/87 (attached). The Guideline applies to residential, commercial and industrial proposals which use individual on-site sewage disposal systems for the treatment of domestic waste. Application to development proposals involving five or fewer units shall be at the discretion of the Regional Director. Although MOEE does not normally review development proposals consisting of 5 or fewer lots, municipalities are encouraged to retain, on their behalf, professionals with demonstrated expertise in hydrogeology with emphasis on development on private services, to review studies prepared in accordance with this Guideline. Municipalities are also encouraged to implement the provisions of this guideline in their consideration of developments by consent or severance.

This guideline **does not apply** to the following:

- Large Subsurface Sewage Disposal Systems as defined in Notice 3/87 (attached);
- the assessment of impacts of existing isolated individual residential sewage systems or interference between individual home systems on existing neighbouring lots within a subdivision (see Note below);
- applications for approval of on-site systems which are replacements due to the failure (e.g., due to hydraulic load, age, etc.) of the original system.

This guideline may not apply to non-standard individual on-site systems which are specifically designed to reduce nitrate loadings. It should be emphasised that MOEE encourages the development of new technologies for the treatment of domestic sewage waste. The Ministry will entertain proposals for development which incorporate new technologies. Contact your regional MOEE office for information on these types of systems.

Note: Where the use of individual on-site systems has resulted in unacceptable impairment of off-site water quality, the issue should be handled in accordance with MOEE Guideline B-9-1 (formerly Policy 15-10), *Resolution of Groundwater Quality Interference Problems.*

4.0 DESIGNATED AREAS UNDER NOTICE 3/87

Under Notice 3/87, the Director under Part VIII of the *Environmental Protection Act* or the MOEE Regional Director may designate a municipality or an area of a municipality as subject to MOEE Guideline B-7.

It is important to note that even though an applicant may meet the requirements of Section 5 of this Guideline, the Director reserves the right to require more detailed assessment or to designate any site or area of a municipality as subject to MOEE Guideline B-7 under Notice 3/87. The likelihood of this occurring is greater where:

a) conditions outlined in Section 5.1 are not met;

b) the development proposed has a higher density than previous development proposals in the municipality;

c) the scale of the proposal is such that an increased degree of assurance is appropriate; or

d) it is known that there are existing high levels of groundwater contamination by nitrate-nitrogen.

When these environments are encountered or these developments are proposed, the Director's support may be conditional upon the establishment of monitoring programs and financial assurances. Under these circumstances contact the local MOEE Regional Office for more information.

Although the Director may support a proposal involving individual on-site sewage systems and permit their installation, the Director does not assume responsibility for failure of the system(s), for correcting the damage to adjacent properties, or for the construction of new sewage systems. This is the responsibility of the proponent/owner of the system.

5.0 GROUNDWATER IMPACT ASSESSMENT IN NON-DESIGNATED AREAS

5.1 General Evaluation

The groundwater impact assessment will address the ability of the lands, identified by and restricted to the development proposal document, to treat sewage effluent to meet acceptable limits. This assessment[1], and the assessment described in the "Technical Guideline for Private Wells: Water Supply Assessment", should be completed and submitted together as one document. Approval Authorities (i.e. the Ministry of Municipal Affairs and/or designate) should only consider support for development applications involving individual on-site sewage systems where the proponent and/or the consultant has:

a) in conjunction with the municipality, defended the use of private services to the satisfaction of the MOEE Regional Director in accordance with the Provincial Comprehensive Set of Policy Statements, particularly, the Policy Statement and Implementation Guideline B7, *Planning for Sewage and Water Services*, and the Policy Statements and Implementation Guidelines B8 through B11, *Growth and Settlement*;

b) demonstrated to the local Health Unit (or to the MOEE, in those areas where MOEE administers the Part VIII Program) that the site complies with the requirements of Ontario Regulation 358 and related policies and guidelines;

c) determined the representative existing background nitrate-nitrogen levels in the receiving groundwater. This determination will involve the collection of groundwater samples from various locations on and adjacent to the development site. The consultant must provide a clear rationale for the number of times the site is sampled, the period of time over which the sampling has been undertaken (capturing seasonal variations), and the manner in which this information is used in the assessment. The consultant must discuss the existing background nitrate-nitrogen concentrations relative to nitrate sources, and the susceptibility of groundwater to contamination.

   The Ministry will normally not support development in areas where background nitrate-nitrogen concentrations exceed 10 mg/L. Where nitrate concentrations between 0 and 10 mg/L are found, the MOEE may also decide not to support development if the proponent's consultant cannot provide a reasonable explanation for the existing levels of nitrate concentration in the groundwater. However, if it can be demonstrated

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[1] Please note that this hydrogeologic study is not the assessment described in the MOEE "Manual of Policy, Procedures and Guidelines for On-Site Sewage Systems." That assessment determines the hydraulic capability of the soil to disperse effluent from a leaching bed on a continuous basis, and does not take into account the potential for contamination of the groundwater. However, it is recommended that this impact prediction not be conducted in isolation from the requirements of this and other related guidelines.

that existing levels of nitrates are the result of historical agricultural practices on the site (for example farming, feed lot, etc.), the proponent may be able to argue that the nitrate levels will decline after development, and;

d) demonstrated that the area is not obviously hydrogeologically sensitive (for example, karstic areas, areas of fractured bedrock exposed at surface, areas of thin soil cover, or areas of highly permeable soils).

It is not the intent of MOEE to promote the development of areas with high infiltration rates (for example, sandy overburden deposits). Due to lack of effective effluent treatment, proposed development on individual on-site systems should not be approved in soils which have high infiltration rates.

5.2 Three-Step Assessment Process

Every proposed development involving individual on-site sewage systems requires an assessment of the groundwater impact potential. The purpose of the assessment is to ensure that the combined effluent discharges from all the individual on-site sewage systems in a development will have a minimal effect on the groundwater and the present or potential use of the adjacent property. For the purposes of this Guideline, the Ontario Drinking Water Ojective (ODWO) of 10 mg/L of nitrate-nitrogen is used as an indicator of groundwater impact potential. This Guideline does not define a precise methodology for determining the expected level of impact; however, it does set out the major considerations which should be included in a defensible assessment of the impact potential.

The assessment involves a three step process. The need to advance to the next step depends on the conditions defined in the previous step. The process is dependent on first satisfying the general requirements defined in Sections 4.0 and 5.1.

The first step involves a definition of the proposed development's minimum lot size. If the minimum lot size is smaller than that defined in Section 5.4, the assessment must progress to the second step, which involves evaluating the relationship between the individual on-site sewage systems and the groundwater. Where it cannot be demonstrated that the systems are isolated from existing or potential groundwater supplies, it will be necessary to progress to the final step of the assessment, which involves a detailed examination of contaminant loading to the groundwater.

Where a report is found to be incomplete, draft or preliminary, or makes unsubstantiated claims, the MOEE will advise the proponent by letter with regard to the report's deficiencies. MOEE may not undertake a full review until such time that a complete report (i.e., one which satisfies the requirement of this Guideline) has been submitted.

5.3 Fundamental Considerations

a) For the purposes of this guideline, the only exceptions to the use of groundwater for anything other than a drinking water supply shall be:

   i) For reasonable uses which involve water quality more stringent than defined by the Ontario Drinking Water Objectives (for example: providing baseflow to a cold water trout stream), or

   ii) At the Director's discretion.

b) Groundwater impact predictions shall be calculated for the development site property boundary.

c) The consultant must make recommendations regarding the optimum location and orientation of leaching beds. In general, the attenuative capabilities of a site can be optimised by maximising separation distances between individual on-site systems and downgradient wells and property boundaries.

d) Where applicable, the impact of the on-site discharge of sewage effluent into surface water must be evaluated. This work must be done by qualified individuals and must address potential impact from phosphorus and other parameters which may be of concern (see MOEE Guideline B-1-1, *Water Management - Policies, Guidelines, Provincial Water Quality Objectives of the Ministry of Environment and Energy*, and contact your local Regional Office). The concentration of phosphate used in assessing the potential impact of sewage effluent should normally be 15 mg/L.

5.4 Step One: Lot Size Considerations

For developments where the lot size for each private residence within the development is one hectare or larger, the risk that the boundary limits imposed by these guidelines may be exceeded by individual systems is considered acceptable in most cases. Developments consisting of lots which average 1 hectare (with no lot being smaller than 0.8 ha), may not require a detailed hydrogeological assessment, provided that it can be demonstrated that the area is not hydrogeologically sensitive. In such circumstances, it is the responsibility of the proponent to obtain a professional analysis from a qualified consultant that the area is not hydrogeologically sensitive.

It is assumed that attenuative processes within a one hectare lot will be sufficient to reduce the nitrate-nitrogen to an acceptable concentration in groundwater below adjacent properties.

It should be noted that sufficient attenuative processes may not be present in hydrogeologically sensitive environments, or where there is little water surplus available.[2]

5.5 Step Two: System Isolation Considerations

Where proposed lot sizes are less than one hectare, the proponent and/or the consultant is/are responsible for assessing the potential risk to groundwater. Developments will normally be considered as low risk where it can be demonstrated that sewage effluent is hydrogeologically isolated from existing or potential supply aquifer(s). In making this assessment, the proponent and/or the consultant must:

a) evaluate the most probable groundwater receiver for sewage effluent: its definition must be defended by hydrogeological data and information obtained through a test pit, auger hole and/or test drilling program; and

b) define the most probable lower hydraulic or physical boundary of the groundwater receiving the sewage effluent.

The consultant must clearly define those portions of the subsurface which will be affected by the effluent. Detailed predictions of the shape of individual contaminant plumes and a description of specific contaminant concentrations over space and time may not be required.

The potential for isolation must be assessed on a site specific basis and may involve assessments of geologic and/or hydraulic boundaries. Please note that this may require hydrogeologic assessment of lands up to 500 metres beyond the actual development boundary.

In some cases, it may be necessary to demonstrate isolation from sensitive surface water environments. Wherever there is a potential for surface water impact, the proponent should contact the MOEE Regional Surface Water staff.

When it has been demonstrated that the sewage effluent will not enter supply aquifers, the lot density of the proposed development may be dictated by factors such as the need for sewage system replacement areas (i.e., contingency area), and by the minimum distances between individual on-site beds and wells, as defined by Ontario Regulations 358 and 903.

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[2] Suitability of the lot for a sewage disposal system is also dependent on approval from the Director under Part VIII of the *Environmental Protection Act*. See the MOEE "Manual of Policy, Procedures and Guidelines for On-site Sewage Systems."

5.6 Step Three: Contaminant Attenuation Considerations

Where it cannot be demonstrated that the sewage effluent is hydrogeologically isolated from all existing or potential supply aquifers, a hydrogeologic study is required to assess the risk that the development's individual on-site systems will cause concentrations of nitrate-nitrogen in groundwater to exceed 10 mg/L at the downgradient property boundary. As described below, there are various methods by which this detailed risk assessment can be done.

5.6.1 Monitoring-Based Assessments

The Ministry recognises that groundwater, infiltrating precipitation and sewage effluent will not be completely mixed at the property boundary. It is also recognised that processes such as absorption, denitrification, filtration and biodegradation may attenuate contaminants as the effluent passes down through the unsaturated zone and moves into the saturated zone. Since these processes are extremely difficult to quantify with any accuracy, they are usually only considered as a safety factor. However, if the consultant can provide documentation to the satisfaction of MOEE regarding the presence and extent of these processes on-site, their impact on nitrate concentrations will be considered. As discussed below, there is a number of ways in which this can be done.

a) Existing Development

In some situations, there may be nearby on-site sewage system-based development in a similar hydrogeological environment. If this development has been in place for a lengthy period of time, information on existing groundwater quality could be used to demonstrate the combined effect of all available attenuative processes. This empirical information may then be used to help predict the impact of the proposed development.

The onus is on the proponent and/or the consultant to demonstrate adequately that:

i) the existing and proposed developments are located in similar hydrogeological environments;

ii) sewage effluent (quantity and quality) from the existing and proposed developments are comparable;

iii) monitoring produces results which accurately represent water quality conditions beneath the existing development. The consultant must provide a clear rationale for the number of times the site is sampled, the period of time over which the sampling has been undertaken (capturing seasonal variations), and the rationale for the way in which this information is used in the assessment.

In general, monitoring of groundwater quality should be concentrated close to the existing individual on-site systems. Due to effluent plumes possibly forming discrete, elongated shapes, intensive monitoring may be required to ensure that monitoring wells located further from the individual on-site systems are measuring effluent concentrations within the effluent plume(s). Water supply wells are not meant to be used as monitoring wells.

b) Phased Development

In situations where there is no existing development, it may be possible to develop lands considered in the planning document in phases, beginning with the upgradient portion. Information obtained from monitoring effluent discharged from individual on-site systems in the upgradient phase, and its impact on groundwater, can then be used to determine the extent to which the downgradient portion of the site can be developed. Before approving such a phased development, the Ministry must be satisfied by the Ministry of Municipal affairs (MMA) or the delegated planning approval authority, that adequate planning controls are in place to regulate development of the downgradient portion of the site.

5.6.2 Predictive Assessment - Residential Development

The Ministry requires the following considerations and assumptions to be used in assessing the combined impact of individual on-site sewage systems at the boundary of residential developments:

a) **Contaminant Source**: In most cases total nitrogen (all species) converted to nitrate-nitrogen is considered as the critical contaminant. For the purposes of predicting the potential for groundwater impacts, a nitrate loading of at least 40 grams/lot/day per residential dwelling unit shall normally be used.[3]

b) **Contaminant Attenuation:**

i) In assessing contaminant attenuation, only dilution will be accepted by the Ministry as a quantifiable attenuation mechanism for nitrate.

ii) Dilution models involve dilution with infiltrating precipitation. Mixing with groundwater flowing through the site will normally not be allowed because it is usually not possible to control upgradient land uses. Flow through will not be

[3] This is based on expected actual flows of 1000 L/day and a minimum value of 40 mg/L nitrate-nitrogen in the discharge from a Class 4 or Class 6 system (see O. Reg. 358) treating domestic/household sewage.

considered where sensitive hydrogeological conditions exist. However, where upgradient lands have been fully developed for a considerable period of time, the quantity and quality of groundwater flow available to dilute the effluent entering the receiving groundwater may be considered.

iii) The amount of available moisture surplus should normally be obtained from Environment Canada. Where available, reliable, long-term, site specific information, obtained from detailed water balance and/or groundwater studies, can be used.

iv) Estimates of the amount of this surplus which infiltrates into the ground must be based on site specific factors such as soils, topography, surface geology, and impermeable areas (including roof tops and paved areas).

v) The volume of sewage effluent, if used as dilution water in mass balance calculations, should not exceed 1000 L/day/lot.

vi) Mathematical (computer) models may be used to assess the impact potential. Although the selection of model software will be left to the proponent, the Ministry must be provided with information on the model's validation and how its limitations and assumptions affect the results. All model simulations must include appropriate sensitivity analyses.

It is the intent of MOEE to allow only those dilution models to be used which are reasonable and can be defended on a site specific basis. Where the Ministry has concerns regarding the predicted impact, the Regional Director may consider designating the development under Notice 3/87.

5.6.3 Predictive Assessment - Industrial/Commercial Development

This guideline only applies to developments which have an average daily flow of less than 4,500 L/day/lot. Developments with larger flows will be assessed according to MOEE Guideline B-7. In addition, the sewage assessed should consist of domestic wastes only. No industrial/commercial cooling or process wastewater is to be considered.

The nitrate loading from industrial/commercial individual on-site systems can vary greatly depending on the type and intensity of use. Since specific uses for each lot or block are not known at the planning document review stage, it is necessary to determine how much nitrate can be discharged from each individual on-site system without exceeding the ODWO of 10 mg/L at the property boundary. The following procedure is then used to set maximum allowable effluent flows for each lot:

a) Available Infiltration:

i) The amount of available moisture surplus should normally be obtained from Environment Canada. Where available, reliable, long-term, site specific information, obtained from detailed water balance and/or groundwater studies, can be used.

ii) Estimates of the amount of moisture surplus which infiltrates into the ground must be based on site specific factors such as soils, topography, surface geology, and impermeable areas (including roof tops and paved areas).

b) Maximum Allowable Flow:

The maximum allowable flow for each lot or block in the industrial/commercial development can be calculated by dividing the amount of available infiltration {from (a)} by a factor of three.[4]

c) Maximum Number of Users:

To determine the maximum number of users which can be supported by the calculated allowable flow, please refer to Appendices 9.3.1 and 9.3.2 of MOEE's "Manual of Policy, Procedures and Guidelines for On-Site Sewage Systems." Restrictions regarding the allowable number of users will normally be incorporated as recommendations in the consultant's assessment, and the recommendations shall be implemented by provisions in the development agreement between the proponent and the municipality.

5.7 Additional Research

The Ministry recognises that the assumptions required for allowing a predicted level of 10 mg/L to be used as a boundary target criterion, for exempting lots of one hectare, or for using nitrate-nitrogen as the critical contaminant etc., may not be technically supported in every case. The Ministry recognises that as research continues, information and technologies may become available which warrant minor or substantial revisions to this guideline.

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[4] This was derived by simplifying the equation (40 mg/L x Flow) / (Flow + Infiltration) = 10 mg/L - Background

6.0 IMPLEMENTATION

MOEE staff will implement this guideline through comments and advice supplied to municipalities, the public, and the approval Authority on planning documents circulated under the *Planning Act.*

For development applications (official plan amendments, plans of subdivision or condominium) involving more than five lots with individual on-site sewage systems, the approval Authority must ensure that an impact assessment has been completed in accordance with this Guideline which demonstrates that the impacts on ground and surface water of the proposal will be within acceptable limits. Shoreline development proposals will be reviewed on a case-by-case basis. The groundwater impact assessment must be approved by MOEE prior to its recommendation that draft approval be granted for plans of subdivision and condominium, and prior to approval of most official plan amendments.

As part of MOEE's recommendation that draft approval be granted, MOEE will request a condition of final approval which specifies that the MOEE receive a copy of a fully-executed subdivision/condominium agreement or other suitable development agreement between the municipality and the developer. The agreement will require that the recommendations of the impact assessment report as approved by MOEE (or its agents) be implemented.

For industrial or commercial development applications involving individual on-site systems, the approval Authority should ensure that a municipal by-law is enacted for the subject lands restricting the industrial/commercial uses to "dry industrial/commercial uses".

7.0 DEFINITIONS

Combined Impact: This refers to the blended impact of all the individual on-site systems on the development site. The impact of the system's effluent discharge on groundwater is not assessed on a plume by plume basis.

Director: Either the Director under Part VIII of the *Environmental Protection Act* or the Regional Director of the MOEE.

Individual On-site Sewage System: An on-site Class 4 or Class 6 sewage system regulated by Ontario Regulation 358 under the *Environmental Protection Act.*

Supply Aquifers: For the purposes of this guideline, a supply aquifer is defined as groundwater which is or which may be used to provide domestic water supply(ies). Designation of groundwater for other than domestic consumption is at the Director's discretion (see Section 5.3).

Dry Industrial/Commercial Uses: Those uses in which only the disposal of the domestic waste of employees is permitted and treated. No industrial liquid wastes, wash or cooling water or process wastes are permitted.

Hydrogeologically Isolated: Those areas characterised by strong upward hydraulic gradients; massive, unfractured clay deposits at or near ground surface; or other thick impervious layers of materials over water-bearing formations.

8.0 REFERENCE DOCUMENTS

Other documents that should be used in conjunction with this Guideline include:

- "Comprehensive Set of Policy Statements", Province of Ontario;

  - Policy Statement B7, "Planning For Sewage and Water Services", Ontario Ministry of Environment and Energy (MOEE);

  - Policy Statements B8 through B11, "Growth and Settlement", Ontario Ministry of Municipal Affairs, (MMA).

- "Implementation Guidelines to the Comprehensive Set of Policy Statements", Province of Ontario

  - Implementation Guideline to Policy Statement B7, "Planning For Sewage and Water Services", Ontario Ministry of Environment and Energy (MOEE);

  - Implementation Guideline to Policy Statements B8 through B11, "Growth and Settlement", Ontario Ministry of Municipal Affairs, (MMA).

- "Technical Guideline For Water Supply Assessment For Private Wells: Water Supply Assessment", MOEE.

- "Manual of Policy, Procedures and Guidelines for On-site Sewage Systems", MOEE.

- "Class Environmental Assessment for Municipal Sewage and Water Projects", Municipal Engineers Association.

- "Class Environmental Assessment Document: Expansion or Upgrading of an Existing Sewage or Water System", Ecologistics Limited and MOEE.

APPENDIX C4

Notice 3/87: Protection of Ground Water Quality

Ontario
Ministry of the Environment
Ministere de l'Environnement

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July 15, 1987

NOTICE 3/87

TO: Directors, Part VII, Environmental Protection Act
RE: PROTECTION OF GROUND WATER QUALITY

Ministry of the Environment Policy No. 15-08 "Incorporation of the Reasonable Use Concept Into MOE Ground Water Management Activities" came into effect April 25, 1986. A copy of the Policy and the referenced document entitled "The Incorporation of the Reasonable Use Concept Into the Ground Water Management Activities of the Ministry of the Environment" - September 1986 are appended for your information.

This policy and its appended document establish the basis for determining the reasonable use of ground water on property adjacent to sources of contaminants, and addresses the levels of contaminate discharge considered acceptable by the Ministry. The document establishes procedures for the determination of what constitutes reasonable use of ground water.

It will be noted that the document and the policy are considered to apply to large subsurface sewage systems (i.e., systems regulated by O.Reg. 374/81, under Part VII Environmental Protection Act).

The fundamental principles contained in Policy 15-08 and its attached document are already embraced in the "Manual of Policy Procedures and Guidelines for Private Sewage Disposal Systems" (Chapter 8 and Chapter 14), and only formalize those concerns

International Year of Shelter for the Homeless
1987
Annee internationale du logement des sans-abri

for the purpose of implementing the Ministry's overall water quality management program as defined in the MOE publication "Water Management-Goals, Policies, Objectives and Implementation Procedures of the Ministry of the Environment".

As you are all aware there is no definition of a large subsurface sewage disposal system contained in either the Environmental Protection Act or O.Reg. 374/81. The Regulation does however contain a definition for a Class A system, and Chapter 14 of the "Manual of Policy, Procedures and Guidelines for Private Sewage Systems" does provide guidance respecting large systems.

For the purposes of implementation of Ministry Policy 15-08, we have defined Large Subsurface Sewage Disposal System as a subsurface sewage system that:

a) has an average daily flow greater than 4500 L/d;

b) serves more than five private residences/dwelling units, with a communal subsurface sewage system; or

c) serves more than five private residences/dwelling units with adjacent individual sub-surface sewage systems and which will be located in a municipality or an area of a municipality designated by the Part VII Director, and/or the Regional Director of the Ministry of the Environment; or

d) serves any institution, industrial or commercial establishment;

but does not include a sub-surface sewage system that:

(i) serves an institutional,; industrial or commercial establishment with an average daily flow less than 4,500 L/d whose waste water consists solely of sewage of domestic origin, which is human body waste, toilet or other bathroom waste, and liquid or water-borne cullinary sink waste.

Clause c) above permits either the Part VII Director or the MOE Regional Director to designate a municipality or an area of a

municipality as subject to Policy 15-08. In such designated areas, any subdivision of more than five private residences/dwelling units with adjacent individual sub-surface sewage systems will be subject to Policy 15-08. Prior to the designation of a municipality or an area of a municipality under Clause c) the respective Directors or their staff should consult with each other in order to establish/ clarify the reasons for the designation and to ensure there is no misunderstanding or confusion.

The purpose of this Notice is to provide all Part VII Directors with guidelines respecting the implementation of Ministry Policy 15-08. The suggested implementation procedures are as follows:

1. In the "Manual of Policies, Procedures and Guidelines for Private Sewage Disposal Systems" it is recommended that applicants proposing large systems undertake to have a pre-consultation meeting with the Part VII Director in order to establish fundamental design criteria etc. for the proposed works. When such meetings are held, Policy 15-08 and its appended document should be brought to the attention of the applicant and the applicant should be requested to address the concerns of the policy and document. As a first step the applicant should confirm the applicability of the policy with the appropriate MOE Regional Office. The decision of the MOE Regional Office and any subsequent assessment of ground water contamination etc. should be included in the applicant's submission to the Part VII Director.

2. Where the MOE Regional Office has determined that Policy 15-08 applies to a specific application, the report and assessment proposed by the applicant's consultant should be submitted to the MOE Regional Office by the Part VII Director for review and comment back to the Part VII Director.

3. When a Part VII Director receives an application for which no pre-consultation meeting has been held or the proponent has not been advised of Policy 15-08, it is recommended that the application be forwarded to the MOE Regional Director for a determination as to the applicability of

the policy. Where the MOE Regional Office determines that the policy is applicable, the Part VII Director should so advise the applicant in order that the required assessment may be prepared. This assessment should be forwarded to the MOE Regional Office by the Part VII Director for review, comment and acceptance/rejection.

4. When an MOE Regional Office cannot support the assessment of the applicant's consultant regarding the impact of the proposed undertaking the applicant should be so advised by the Part VII Director. Should the applicant choose to appeal the decision MOE Regional staff will act as expert witnesses on behalf of the Part VII Director at the Environmental Appeal Board Hearing.

Should you have any questions respecting the preceding or the attached we would request that you contact either the Technical Support Manager of the MOE Regional Office or, Mr. Brian J. Cooper, On-Site Sewage Systems, (416) 323-4503.

for W.R. Balfour
Director
Environmental Approvals and
Land Use Planning Branch

C.E. McIntyre
Executive Director
Approvals and Engineering

BJC/lh

cc: MOE Regional Directors
MOE Managers - Abatement
MOE Managers - Technical Support
MOE District Officers
Regional Municipalities
Chairman, Local Boards of Health, Medical Officers of Health, Health Unit Director, Health Unit Officers and Sub-officers, Ministry of Health - Public Health Branch
Environmental Health Department - Ryerson Polytechnical Institute.

APPENDIX C5

Streamlining Regional Reviews of Submissions For Hydrogeologic Studies

STREAMLINING REGIONAL REVIEWS

OF

SUBMISSIONS FOR HYDROGEOLOGIC STUDIES SUPPORTING APPLICATIONS FOR LARGE SUBSURFACE DISPOSAL SYSTEMS, AND ON-SITE SUBSURFACE SEWAGE DISPOSAL SYSTEMS IN DESIGNATED AREAS

SEPTEMBER 1992

INTRODUCTION

This report contains recommendations to enable Regional staff to expeditiously review hydrogeological reports pertaining to large subsurface disposal systems and on-site subsurface sewage disposal systems in designated areas in accordance with Policy 15-08.

CONCLUSIONS AND RECOMMENDATIONS

The basic conclusions reached are:

1) All submissions require detailed review.

2) The greatest cause for delays is incomplete submissions from the proponents or their consultant.

3) Review periods could be shortened if there was more accountability placed on proponents/consultants to submit complete documentation.

4) Clearer direction is required on the priority and time frames for reviewing hydrogeological reports.

5) The extent of review required for a hydrogeological report is dependent on many non-hydrogeological factors. Therefore, the extent of review is determined on a case-by-case basis.

The recommendations are:

1) Provide a Ministry position statement outlining review process for hydrogeological reports. This statement could also indicate the number of copies of reports required and their distribution.

2) Each Region should have a tracking system that indicates such information as:

   (a) date of receipt by Ministry,

   (b) staff member assigned to conduct review

   (c) date review is to be completed

   (d) date submission received by hydrogeologist

   (e) date review completed.

3) Both the proponent and the proponent's consultant should be advised when a submission is returned because of incomplete information.

4) A Ministry guidance document for submitting hydrogeological reports should be distributed to proponents/consultants. A draft guidance document appears in Appendix A.

5) A screening checklist should be completed by proponents/consultants and submitted with the hydrogeological report and application for Certificate of Approval. Ministry staff would use the check list as an initial screening for completeness of submission. A draft checklist appears in Appendix B.

6) In the longer term have accessible groundwater information systems and groundwater management plans that would facilitate and expedite the review.

APPENDIX A

GUIDANCE DOCUMENT FOR SUBMISSIONS

GUIDELINES FOR HYDROGEOLOGICAL REPORTS SUPPORTING SUBMISSIONS FOR LARGE SUB-SURFACE DISPOSAL SYSTEMS, AND ON-SITE SUB-SURFACE SEWAGE DISPOSAL SYSTEMS IN DESIGNATED AREAS

The purpose of the guidelines is to ensure that hydrogeological studies are undertaken in a complete and consistent manner. This approach should result in minimization of potential adverse impacts on groundwater and surface water, and on the people who reside, work or play on the development site and surrounding lands.

The study submitted should deal with all hydrogeological issues (i.e. physical setting and development impact). The study should also contain a clearly stated set of conclusions and a set of recommendations for all hydrogeological components. The impact of sewage system effluent on the groundwater resource must be evaluated. The Ministry will expect the techniques used, conclusions and recommendations to be the sole responsibility of the consultant. In order to reduce delays created by incomplete submissions, a check list of information should be submitted with the hydrogeologic report. The check list is used by the Ministry in the initial screening of the submission. Hydrogeological reports must include *(but may not necessarily be restricted to)* the following information.

PHYSICAL SETTING

- Provide regional and local maps which show site location and orientation with Lot and Concession Numbers. Use topographic maps of 1:10,000, 1:25,000 or 1:50,000 scale, from Ontario Base Mapping or National Topographic Series. Use maps of the scales that best describe the site and that best show its location.

- Describe topography and surface drainage conditions, as well as adjacent wetlands, watercourses and flood plains within at least 500 metres of the site. Make use of maps to clearly locate these features.

- Identify surrounding land uses and types of servicing, and identify on-site land use. Use maps to depict this information.

- A clear description of the hydrogeological setting using maps, bore hole logs, soil types at various depths and cross sections.

- Identify any groundwater sources, any aquifers and any water uses in the area.

- Identify and provide references to all applicable studies/reports available for the area.

IMPACT ASSESSMENT

- Include an assessment of the potential risk to groundwater resources through an evaluation of the migration of the effluent. A definition of the most probable contaminant migration pathway must involve a standard hydrogeologic assessment of the site incorporating test pits, auger holes, well records, test drilling and/or other means. This assessment must consider the entire site as well as surrounding lands.

- All assessments must involve a description of the groundwater sources including aquifer/aquitard physical parameters and existing/potential uses. Aquifer uses are not necessarily restricted to anthropogenic uses (for instance, supply base flow to a cold water stream). Such uses may involve water quality criteria more stringent than the Ontario Drinking Water Quality Objectives.

- The determination of the potential for impact on the groundwater resources will be dependent upon definitions of:

  a) the degree of isolation between the proposed disposal systems and any groundwater supply, and

  b) the expected attenuation of contaminants within the subsurface.

- Where there is a potential for surface water impact, the proponent is required to address the concerns of the Regional Surface Water Unit.

- The hydrogeologic study will determine the impact potential of the subsurface disposal system on the groundwater at the site boundary. The critical contaminant at the predicted boundary must comply with Policy 15-08.

MONITORING PROGRAM AND CONTINGENCY PLAN

- Unless justification is provided otherwise, a monitoring program is required and it must conform with standard hydrogeological practices.

- Unless justification is provided otherwise a contingency plan is required.. Included should be pre-determined levels identified in the monitoring program that will activate the contingency plan.

APPENDIX C6

Streamlining The Approval Of Discharge Criteria To Surface Water

STREAMLINING THE APPROVAL OF DISCHARGE CRITERIA TO SURFACE WATER

SEPTEMBER 1992

INTRODUCTION

This report contains recommendations to enable Regional staff to expeditiously review consultant's discharge criteria reports that support applications for Certificates of Approval.

CONCLUSIONS AND RECOMMENDATIONS

The basic conclusions are:

1) The greatest causes for delays are incomplete submissions from the consultant, and limited resources in the Regions.

2) The overall approval process could be shortened if there was more accountability placed on consultants to submit complete documentation.

3) Clearer direction is required on the priority of reviewing discharge criteria reports.

4) More Regional resources are required to ensure reviews are conducted expeditiously.

The recommendations are:

1) Provide a Ministry policy statement outlining review times for discharge criteria reports.

2) Each Region should have a tracking system that indicates such information as:

   a) date of receipt by Ministry

   b) staff member assigned to conduct review

   c) date review is to be completed

d) date submission received by technical reviewer

e) date review completed.

3) To place more accountability on consultants by advising both the proponent and the proponent's consultant when a submission is returned because of incomplete information.

4) Regional staff adopt the position of not reviewing draft reports from consultants for discharge criteria but more emphasis should be placed on pre-submission consultation.

5) A Ministry guidance document be prepared to guide consultants in the preparation of proposals for discharge criteria to surface water. A draft guidance document appears in Appendix A.

6) A screening check list should be submitted by the consultant with the discharge criteria report and the application for a Certificate of Approval. The check list should be initially reviewed by Regional staff for completeness. A draft check list appears in Appendix B.

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APPENDIX A

GUIDANCE DOCUMENT FOR THE DEVELOPMENT OF SURFACE WATER DISCHARGE CRITERIA

GUIDANCE DOCUMENT FOR THE

DEVELOPMENT OF SURFACE WATER DISCHARGE CRITERIA

August 1992

RODUCTION

In developing effluent criteria for point source discharges to Provincial surface rs, a series of consistent criteria should be met province wide. Additional or more gent site specific criteria may be required by Regional Technical Assessment staff based neir knowledge of the sensitivity of the proposed receiver. If site specific information is own, field data collection may be required by the proponent to determine the sensitivity. proponent should contact Regional Technical Assessment staff for information on the re of the data to be collected. At the end of this document, a short list of suggested ence documents is presented.

The development of discharge criteria must be consistent with the Ministry of the ronment legislation. Section 14 of the Ontario Water Resources Act (January 1991) s: Under sections 15, 16, 18 and 19, the quality of water shall be deemed to be impaired otwithstanding that the quality of the water is not or may not become impaired, the rial discharged or caused or permitted to be discharged or any derivative of such rial ca es or may cause injury to any person, animal, bird or other living thing as a t of the use or consumption of any plant, fish or other living matter or thing in the water the soil in contact with the water. Section 16(1) then goes on to say: Every person that arges or causes or permits the discharge of any material of any kind into or in any rs or on any shore or bank thereof or into or in any place that may impair the quality of ater of any waters is guilty of an offence. Section 13(1) of the Environmental ction Act (October 1990) states: Notwithstanding any other provision of this Act or the ations, no person shall discharge a contaminant or cause or permit the discharge of a minant into the natural environment that causes or is likely to cause an adverse effect.

Section 1 (1)(a) of the same Act defines adverse effect as one or more of (i) impairment of the quality of the natural environment for any use that can be made of it, (ii) injury or damage to property or to plant or animal life, (iii) harm or material discomfort to any person, (iv) an adverse effect on the health of any person, (v) impairment of the safety of any person, (vi) rendering any property or plant or animal life unfit for use by man, (vii) loss of enjoyment of normal use of property, and (viii) interference with the normal conduct of business. The proposed discharge criteria must also take into account the provisions of the Federal Fisheries Act which has the Ministry of Natural Resources as their agent in Ontario.

All new (or expanded) effluent discharges should be non-toxic. To be non-toxic, all variables in the discharge, including ammonia, hydrogen sulphide, chlorine, dissolved oxygen and heavy metals, must pass a 96 hr. LC 50 (to normal test species - e.g. rainbow trout/Daphnia). Older waste water discharges would be reviewed when they come up for expansion or during changes to their existing Certificates of Approval. This Ministry's goal to eliminate persistent toxics from the environment should also be used as a guiding principle in developing effluent criteria.

The following should provide some direction to consultants, municipalities, industries and the public regarding the assessment information used or required to determine effluent criteria for Certificates of Approval. This list is not all inclusive, and it is strongly suggested that the Regional Surface Water Assessment staff be contacted to determine if additional site specific conditions would apply to any effluent discharge.

QUANTITY CONSIDERATIONS

Discharges to Rivers/Streams

For continuous point source discharges, the low flow statistic 7Q20 (minimum 7 day average flow with a recurrence period of 20 years, i.e. 5% chance of non-compliance in any given year) is used as the basic design flow for the receiving stream. This value can be

culated based on data collected by Water Surveys of Canada or from publications like the nistry of the Environment Report "Low Flow Characteristics in Ontario".

For non-continuous point source discharges, a low flow statistic 7Q20 for the specific charge period should be used as the basic design flow for the receiving water stream. Guidance should be sought from the Regional Surface Water Assessment staff to ensure appropriate seasonal low flow design criteria are selected.

Streamflow paced discharges may be permitted when assimilative studies indicate the ed and storage or discharge volumes and/or quality can be controlled. Effluent criteria are pulated to maintain set dilution ratios based on the flow in the receiving stream or allowed ncentrations of selected variables (based on stream sensitivity) in the receiver after mixing. ne proponent may be required by a condition on the Certificate of Approval to install, aintain and operate a continuous recording streamflow gauge (according to the National andards).

Discharges to dry ditches (water courses that go dry seasonally) may be permitted in me instances. In these cases, best available technology and a non-toxic effluent are quired. Typical best available technology for effluent discharges would have non-mpliance criteria of: BOD_5 10 mg/l, suspended solids 10 mg/l, total phosphorus 0.3 to 0.5 g/l, total ammonia 1 to 3 mg/l and chlorine absent. Additional assessments may be equired to confirm that the discharge will not impact aquatic life or other water uses ownstream where there is continuous streamflow (secondary receiver).

Early consultation should be conducted with the Regional Water Resources ssessment staff to confirm acceptability of the approach used to pro-rate streamflow nformation from a gauging station to the proposed discharge location. If insufficient treamflow data are available, one or more seasons of gauging may be required to develop a orrelation between the selected location and other gauging location(s) with a long term ecord.

Discharges to Lakes

Shoreline discharges to any lake are not acceptable for new or expanded waste water discharges. A discharge of storm water and/or cooling water may be considered on a case-by-case basis. Contact Regional Water Resources Assessment staff for advice on acceptability.

Initial mixing for discharge diffusers in lakes must have a minimum near field (initial mixing) ratio of 20:1. Additional site specific conditions (i.e. spawning shoals, beaches, water intakes, minimum depth of submergence and distance off shore etc.) should be determined with the assistance of the Regional Water Resources Assessment staff.

Information on the impacts of diffusers should include the rationale for the factors that were used in the dilution calculations (i.e. variation in initial dilution between start up flows and ultimate flows, buoyant versus non-buoyant plumes, current speeds etc.)

QUALITY CONSIDERATIONS

Background water chemistry conditions are used in the development of effluent criteria for Certificates of Approval. The following factors are considered when selecting an appropriate background or reference value for these assessments:

- Number of analyses and period of record;
- Variability of the database;
- Validity, integrity and relevance of the values or records available;
- Potential toxicity of the variables;
- Potential bio-accumulation of each variable.

Seasonal and/or diurnal changes or fluctuations (i.e. temperature, dissolved oxygen, pH), and impacts should be considered when evaluating or determining reference conditions. Normally the 75th percentile should be used to determine reference quality, but with proper

justification this value may be modified based on stream sensitivity and the above mentioned considerations. Outliers in the data base may be eliminated but the justification must also be presented. The user must be able to justify the values and amount of data used and show no additional data collection is required. Again, it is strongly recommended that the proponent obtain direction and advice from the Regional Water Resources Assessment staff on the determination of background or reference water chemistry conditions.

Pre-operative assessments may be required when minimal information is available at the pre-submission consultation, or there is concern that appropriate protection of the receiving water body may not be achieved given the available information used to derive effluent criteria. Assessments may incorporate water quality/quantity, biological and sediment surveys.

The use of aquatic invertebrate data may provide an indication of the minimum water quality conditions that have occurred in the stream over the life cycle of the species found. This may then be used as background or reference conditions.

Background or reference determinations must use the entire database to determine the appropriate value for each variable assessed. In cases where water chemistry may have changed due to such things as development or containment of discharges, the period of record may be reduced.

As a minimum, all municipal and private domestic sewage discharges must be evaluated for the following variables: suspended solids, BOD_5, total phosphorus, ammonia and chlorine residual. Any waste water treatment plant that receives industrial discharges should also have a waste water characterization study (i.e. metal scans etc.) performed to confirm that there are no additional variables of concern.

Commercial and industrial discharges are assessed for the major variables expected or identified by the proponent based on specific knowledge of the process and site specific conditions of the receiving stream. Industrial and commercial plants should provide a waste

water characterization study so that variables of concern can be determined and control levels included on the Certificate of Approval.

POLICY CONSIDERATIONS

For the development of discharge criteria, the publication, Water Management Goals, Policies, Objectives and Implementation Procedures of the Ministry of the Environment, November 1978, Revised May 1984 (generally referred to as the "Blue Book") is the primary document used to provide interpretation of the legislation. Surface water quality management is dealt with under Policies 1 through 5. The remaining Section deals specifically with "Blue Book" Policies 1 through 5. The appropriate Region should be contacted to confirm that no additional policies should be considered in the development of the discharge criteria.

In some cases, in areas where water quality is better than the Provincial Water Quality Objective ("Blue Book" Policy 1), streams may be allowed to be degraded for a specific variable to the Provincial Objective in accordance with "Blue Book" Policy 3. Degrading of water quality beyond the objectives is not allowed.

"Blue Book" Policy 2 deals with areas where the water quality does not presently meet the Provincial Water Quality Objective. Single exceedences of the objective may constitute a Policy 2 designation for that variable. In Policy 2 designated areas, no further degradation is allowed and remedial measures shall be put in place to upgrade the water quality to the provincial objectives as stipulated under Policy 3. Daily, seasonal and annual concentrations and loads from proposed waste water discharges should be evaluated to confirm that they will not violate Policy 2. Expansion of existing discharges to Policy 2 receivers will only be permitted if the total load is not increased, or if a Deviation from Policy 2 is granted.

In exceptional cases for Policy 2 areas, where it is clearly demonstrated that all reasonable and practical measures to attain the Provincial Water Quality Objectives have been undertaken but where:

1) the Provincial Water Quality Objectives are not attained because of natural background water quality; or

2) the Provincial Water Quality Objectives are not attained because of irreversible man-induced conditions; or

3) to attain or maintain the Provincial Water Quality Objectives would result in substantial and widespread adverse economic and social impact; or

4) suitable treatment techniques are not available;

then deviations from Policy 2 may be allowed, subject to the approval of the Director, Water Resources Branch, in consultation with the appropriate Regional Director. If a deviation for a specific parameter or variable is being sought, it must be clearly stated in the assessment document and must be applied for at the same time as the application for a Certificate of Approval. A deviation would be required for each variable that has been designated as Policy 2 and may be further degraded as a result of the discharge. Any deviation applied for, must be granted prior to the issuance of the Certificate of Approval.

"Blue Book" Policy 3 outlines the requirement for any discharge to meet the more stringent of the receiving water requirement derived or appropriate Federal or Provincial Regulations and/or Guidelines and controls on non-point sources of pollution. Guidance should be sought from the Regional Water Resources Assessment staff on acceptable site-specific receiving water assessments for the water course or body involved.

The allowable discharge of hazardous substances in an effluent may vary from zero to trace depending on the chemical compound in question ("Blue Book" Policy 4 addresses). Clarification of compounds that are suitable for discharge along with their allowable concentrations must be sought from staff of the Regional Water Resources Assessment Unit.

"Blue Book" Policy 5 defines Terms and Conditions related to mixing zones which may be allowed to dilute the discharge from non-toxic to the Provincial Water Quality Objectives. However, mixing zones must not be used or considered as an alternative to adequate treatment. Mixing zones should not contain:

1) materials which form objectionable deposits, colour, odour, turbidity, or tastes;

2) substances which produce objectionable growths of nuisance plants and animals;

3) substances which render the mixing zone aesthetically unacceptable.

A mixing zone shall not be allowed to create a barrier to the migration of fish and other forms of aquatic life. The presence of a mixing zone should in no way pose a threat to the species survival of any organism in the receiving water outside the mixing zone.

No condition within the mixing zone should be permitted which:

1) are rapidly lethal (96 hr LC 50) to aquatic life; or
2) cause irreversible responses which could result in detrimental post-exposure effects (i.e. gill damage caused by chlorine); or
3) result in bio-concentration of toxic material which are harmful to the organism or its consumer; or

4) attract organisms to the mixing zone, resulting in a prolonged or lethal exposure period (thermal discharges).

The size and use of mixing zones will be established on a case-by-case basis depending on the local water quality conditions and water use, secondary receiver quality and use, along with the parameter or variable requiring dilution in the discharge. Contact Regional Water Resources Assessment staff for assistance to determine the acceptability and appropriateness of a mixing zone.

OTHER CONSIDERATIONS

Post-operative assessments may be required when minimal information is available for inclusion with the application for a Certificate of Approval, or there is concern that appropriate protection of the receiving water body may not be achieved given the information used to derive the effluent criteria. The Certificate of Approval will specify any milestones and/or triggers that may be required (plant closure, forced process upgrade, etc.) for the remediation.

Biological criteria may be used in a Certificate of Approval where some type of biological monitoring is required. Failure to maintain specified biological conditions or specific criteria usually requires studies to be done to determine the cause of the change or loss identified as the objective. Requirements for biological monitoring are normally determined in consultation with Regional Water Resources Assessment staff.

All criteria on a Certificate of Approval are stand alone (hydraulic, concentrations and loadings). Non-compliance of either the hydraulic, concentration or loading figures stipulated on the Certificate of Approval is a violation and is grounds for enforcement and prosecution.

REFERENCES

Environment Canada, annual publication, "Surface Water Data, Ontario 19XX", Inland waters Directorate, Water Resources Branch, Water Survey of Canada, Ottawa, Ontario.

Ministry of Environment, November 1978, revised 1984. "Water Management - Goals, Policies, Objectives and Implementation Procedures of the Ministry of the Environment" (Blue Book), Toronto, Ontario

Ontario Ministry of the Environment, Water Resources Branch, annual publication, "Water Quality Data, Ontario Lakes and Streams, 19XX", Toronto, Ontario

Ontario Ministry of the Environment, Water Resources Branch, June 1989. "A Report on Low Flow Characteristics in Ontario", prepared by Cumming Cockburn Limited, Toronto, Ontario

APPENDIX B

SCREENING CHECK LIST FOR SUBMISSIONS ON DISCHARGE CRITERIA TO SURFACE WATER

SURFACE WATER DISCHARGE CRITERIA CHECK LIST

Please note:

- all concentrations to be expressed in mg/l
- flows in m3/s or l/s
- if insufficient room, provide references to supporting documentation
- additional information may be required depending on site specific conditions or problems

SECTION 1 - EFFLUENT DISCHARGE

Project Name: _____

Ownership: _____

Project type: _____
(domestic sewage, mine tailings, etc.)

Proposed treatment process: _____
(extended air, lagoon, etc.)

Discharge location:
(attach site map showing treatment works, receiver and outfall locations):

Plant design capacity:

Daily average: ____ Daily maximum: ___ Annual volume: ___

Discharge type: _____ Continuous: ___ Intermittent: ___

If intermittent, based on: Seasonal: ___ Annual: ___ Other: ___
If other, please specify

Lagoon design capacity: Volume (m3): ___ Storage (days): ___

PROPOSED EFFLUENT CRITERIA

Parameters considered must include BOD5, Suspended Solids, Total Phosphorus, Ammonia, and Chlorine Residual. Include concentrations, daily and annual loadings.

Similar information is required for each additional identified parameter of concern.

PARAMETER	CONCENTRATION	DAILY LOAD	ANNUAL LOAD

Attach a separate sheet if more room is required _____

Will the effluent pass toxicity tests? Yes ___ No ___

Is effluent disinfection required? Yes ___ No ___

Disinfection procedure: UV ___ Ozone ___ Chlorine ___ Other ___

SECTION 2 - RECEIVER

Name(s): include primary, secondary, and subsequent receivers if potentially impacted.

Low flow used: (m3/s)

7Q20: _____ for the period _____ (annual or specific mos.)

Other statistic: (specify reason)

Flow is: regulated ___ natural ___ intermittent ___ dry ditch ___

If regulated, who is the controlling agency?

Background Quality (all identified parameters of concern)

Source of data:

PARAMETER	MEDIAN CONC.	MAX. CONC.	# OBSERVATIONS

Attach a separate sheet if more room required ___

Type of assessment used:

Mass balance ___ Mathematical Model ___ Diffuser & initial mixing ___ Other: (please speci

___

Is a Policy II deviation required? Yes ___ No ___

If yes, please specify for which parameter(s)

Is request for deviation included? Yes ___ No ___

Outfall considerations:

Submerged diffuser ___ Depth (m): ___

Initial Dilution ratio ___ Distance from shore (m): ___

Current pattern assessment ___ (refer to report)

Identified downstream/near shore uses: (fisheries, intakes, recreation, other discharges, etc.)

Is a Mixing Zone required: ___ Parameters? _____

Have Blue Book Policy 5 considerations been addressed?

Was a baseline benthic assessment required? Yes ___ No ___ Included ___

Was a baseline Biological inventory completed: Yes ___ No ___

Have Regional/Water Resources staff been contacted? Yes ___ No ___

Contact names:

Submitted by: Date:

APPENDIX C7

Streamlining Processing Applications for Permits To Take Water From Ground Water Supplies

STREAMLINING PROCESSING APPLICATIONS FOR PERMITS TO TAKE WATER FROM GROUNDWATER SUPPLIES

September 1992

INTRODUCTION

The PTTW program is designed to ensure proper management and fair sharing of groundwater.

This report contains recommendations to enable regional staff to process Permits To Take Water (PTTW's) from groundwater supplies expeditiously (30 day turn around) without increasing environmental risks.

The recommendations are based on the following basic concepts:

1. Provide a clear mandate that indicates processing deadlines and accountability.

2. Improve the quality of applications/submissions.

3. Increase accountability of proponents and their consultants.

4. Provide guidance on the level of hydrogeological review required by Ministry staff.

In addition the report contains a suggestion for a long-term approach to improve the environmental management of groundwater supplies.

Applications for PTTW's are associated with the following types of takings:

1) Communal Water Supplies

2) Commercial and Industrial

3) Irrigation

4) Pits and Quarries

5) Heat Pumps

6) Groundwater Treatment (contamination clean-up)

7) Short Term Taking (construction dewatering, testing)

8) Miscellaneous (structural drainage works, recreational).

In our review of the PTTW process the types of taking were divided into two categories of applications:

a) PTTW applications requiring a Certificate of Approval (communal water works, commercial and industrial discharges to a watercourse, open-loop heat pumps, contaminated groundwater treatment systems).

b) PTTW applications not requiring a Certificate of Approval under the OWR Act.

RECOMMENDATIONS

1. Provide a Ministry policy statement to process applications for PTTW's, which have all the pertinent information, within a specific time (30 days after receipt recommended). For each region it may be advantageous to specify maximum time periods for different stages, e.g. 3 days for initial receipt and distribution to groundwater specialist; 21 days for groundwater review; 7 days to issue permit. Where external reviews are required, appropriate time must be provided.

2. Elevate the priority for processing applications for PTTW's to ensure that the specified review time (30 days) is met.

3. Develop a tracking system that indicates such information as:

a) date of receipt by the Ministry,

b) date report forwarded to groundwater specialist for review,

c) date processing of application is to be completed,

d) date forwarded to outside consultant or external review,

e) date technical review is completed,

f) accountable staff,

g) date permit issued, rejected or returned due to incomplete information.

4. PTTWs be issued conditional to the issuance of Certificate of Approval.

5. Both the proponent and the proponents' consultant should be advised when an application is returned because of incomplete information

6. Develop explicit guidelines indicating the minimum supporting documentation to accompany applications for PTTW's. Draft guidance documents pertaining to Permit To Take Water applications appear in Appendix A. The guidance documents include a definition of low risk of interference and an indication of the supporting documentation required for takings with low risk of interference.

7. Develop forms to serve as checklists for both the proponent and the Ministry. The checklists are to accompany applications. They will indicate the completeness of submission and allow screening for completeness by non-technical staff of the Ministry prior to being forwarded to groundwater specialists for review. Draft check lists appear in Appendix B.

9. Develop a new "Application for Permit To Take Water" that would reflect minimum supporting documentation requirements.

10. In order to comply with the OWR Act continue to issue short-term PTTW's for pump tests. It may be possible to use a Permit-By-Rule or standardized letter of approval approach for water takings in association with pump tests.

11. Develop a communication package outlining requirements for water takings.

RECOMMENDED LONGER-TERM APPROACH

In the longer-term a water budget approach is recommended. This would require knowledge of the capability of the aquifers to supply water, current water usage, etc.

To provide time to gather the information on the aquifers in a region, it will be critical to upgrade submissions for PTTW's and to assign more accountability to the proponent and the proponent's consultant.

The water budget approach could be phased in on an aquifer by aquifer basis.

APPENDIX A

GUIDANCE DOCUMENTS FOR INFORMATION

REQUIRED IN SUBMISSIONS FOR PERMITS TO TAKE WATER

GUIDANCE DOCUMENT FOR INFORMATION REQUIRED FOR THE REVIEW OF CERTIFICATE OF APPROVAL AND PERMIT TO TAKE WATER APPLICATIONS FOR COMMUNAL WATER SUPPLIES

The following should provide some direction on information requirements for communal water supply applications. In remote areas of northern Ontario, pre-submission consultation is highly recommended in order to determine appropriate requirements.

1. Reports (engineering design brief, preliminary hydrogeology and well construction reports, including water quality testing and proposed treatment) are to be submitted and reviewed concurrently.

2. Complete submissions are to be provided to both the Approvals Branch and the Regional Approvals Unit.

3. PTTW will be issued conditional to the issuances of Certificate of Approval.

4. The engineering design brief must be based on the number of lots and industries and commercial establishments to be serviced with appropriate population figures and the expected realistic consumption figures based on MOE guidelines and/or historical figures available and proposed storage capacity, bearing in mind that water conservation is the Ministry's goal. It should also contain information on proposed treatment.

5. The PTTW application must be based on the water consumption figures presented in the design brief (i.e. maximum day figure should be equivalent to the maximum amount taken in a day). Pumping capacity to reflect peak demands could be higher than the maximum day equivalent of the 24-hour pumping figure but it must be equal to the maximum equipped pumping capacity.

6. The average day figure is normally equivalent to the perennial yield, however, in certain critical cases, the capacity and impact for the maximum day figure for a 90-day (summer) period must also be considered and must be included in the overall perennial yield calculations.

7. All maps should be properly labelled and indicate scale and orientation (North arrows).

8. The hydrogeological report should include:

   (a) the description of the hydrogeological setting of the well(s);

   (b) location plot of the well(s), observation wells, test holes and area wells on the best available and appropriate scale (normally for areal well plots 1:10,000 maps should be used);

   (c) all local wells (recorded and unrecorded) should be tabulated with all relevant information, i.e. log, depth, static, pumping water levels, pump setting, rated pumping capacity, screen(s) and locations must be field checked;

   (d) at least two cross sections through the well(s);

   (e) estimate on the recoverable recharge in the area and comments on the potential of aquifer mining;

   (f) assessment of the susceptibility of the aquifer to contamination and the need for a well head protection area;

   (g) assessment of interference potential on groundwater and surface water.

(h) The well construction information should include:

- well field design, distances between wells;
- a detailed well construction diagram indicating casing joints, groutings, wall thickness, screen slot size, length and diameter;
- elevation of measuring point of well(s);
- MOE well logs for the proposed production well(s) and observation wells and test holes and vicinity supply wells;
- step test (at least four to maximum capacity of well), prolonged aquifer test (at the design rate for at least 24 hours), static levels, elevation of measuring point, method of water level and flow measurement, orifice and pipe diameters and manometer heads;
- a pumping test analysis, such as Jacob's, with justification of selected methodology. The analysis should include time and drawdown for pumping and recovery/residual drawdown, as well as, distance-drawdown curves (if observation wells are available); estimate of the 20-year perennial yield and capability to supply the required amount specified in the design brief; comments on positive and negative boundaries;
- comment on method of disposal of pumped water during the test;
- well efficiency and well loss calculations;
- screen entrance velocity calculations;

- comments on well alignment (plumbness and well alignment diagram) and sand-free condition testing;

- complete water quality analysis (chemical and bacteriological). Contact Regional Water Resources Unit for guidance;

- discussion of water quality problems and potential treatment; and

- potential (nitrate) impact calculations on the proposed production well(s) and adjacent properties.

9. Recommendations should include but not be limited to:

- Plan to overcome forecast interference i.e. lower pump intakes, deepen or drill new wells, limit taking, etc. including sufficient information to support feasibility of the approach.

- Monitoring plan including specific targets i.e. water level or other parameters to trigger a "Contingency Plan" which will prevent interference.

- The "Contingency Plan" must establish a process for dealing with validation and resolution of interference claims and include details for ensuring continuity of affected supplies i.e. interim and permanent; including feasibility costs and proposals for "Financial Assurance".

GUIDANCE DOCUMENT FOR INFORMATION REQUIRED WITH AN APPLICATION FOR A PERMIT TO TAKE WATER ASSOCIATED WITH A CERTIFICATE OF APPROVAL OTHER THAN A COMMUNAL WATER SUPPLY

---

a) Completed PTTW application.

b) Location map including scale or separation distances from all wells (water supply, observation, heat pump, etc.), surface water bodies, etc. It should also indicate for reference: Township names, concessions and lots, local roads and a north arrow. Note: the area of survey should be appropriate to encompass the anticipated radius of influence or minimum of .5 km radius.

c) Subsurface information: water well records for all wells and a field survey of all unrecorded wells within survey area i.e. water supply, observation, heat pump wells , etc. including details on pumping equipment and intake levels, information on subsurface conditions encountered by test pits, exploratory bore or drill holes, dug out ponds and vicinity pits, quarries or other excavations.

d) Pumping test(s): must be adequate in duration, pumping rate and water level monitoring to accurately determine aquifer characteristics and safe perennial yield. All water level monitoring for production and observation wells must be provided including interpretation and conclusions by a qualified professional.

e) Assessment of potential for interference of water supply or other interests in the use of the local groundwater resource to be prepared by a professional qualified in the field of hydrogeology. The submission should include all technical documentation and graphical or other illustrations necessary to support his/her interpretations, conclusions and recommendations.

f) A plan to obtain pre-taking water quality and level information from survey area well supplies.

g) Recommendations should include but not be limited to:

- Plan to overcome forecast interference i.e. lower pump intakes, deepen or drill new wells, limit taking, etc. including sufficient information to support feasibility of the approach.

- Monitoring plan including specific targets i.e. water level or other parameters to trigger a "Contingency Plan" which will prevent interference.

- The "Contingency Plan" must establish a process for dealing with validation and resolution of interference claims and include details for ensuring continuity of affected supplies i.e. interim and permanent; including feasibility costs and proposals for "Financial Assurance".

GUIDANCE DOCUMENT FOR INFORMATION REQUIRED WITH AN APPLICATION FOR A PERMIT TO TAKE WATER NOT ASSOCIATED WITH A CERTIFICATE OF APPROVAL UNDER THE OWR ACT

---

a) Completed PTTW application.

b) Location map including scale or separation distances from all wells (water supply, observation, heat pump wells, etc.) surface water bodies, etc. It should also indicate for reference: Township names, concessions and lots, local roads and a north arrow. Note: the area of survey should be appropriate to encompass the anticipated radius of influence or minimum of .5 km radius.

c) Subsurface information: water well records for all wells (recorded and unrecorded) within survey area i.e. water supply, observation, heat pump wells, etc. including details on pumping equipment and intake levels, information on subsurface conditions encountered by test pits, exploratory bore or drill holes, dug out ponds and vicinity pits, quarries or other excavations.

d) Pumping test must indicate water level at start of test, at the end of pumping, and the recovery time to reach level at start of test. Test to be conducted at maximum design rate.

e) It is recommended that at least one neighbouring well be monitored for water level during the pump test.

- The information provided in a) through e) may be sufficient if in the opinion of the Ministry the taking would represent a low risk of interference. If the taking is not deemed low risk then the following additional information is required.

f) Pumping test(s): must be adequate in duration, pumping rate and water level monitoring to accurately determine aquifer characteristics and safe perennial yield. All water level monitoring for production and observation wells must be provided including interpretation and conclusions by a qualified professional.

g) Assessment of potential for interference of water supply or other interests in the use of the local groundwater resource to be prepared by a professional qualified in the field of hydrogeology. The submission should include all technical documentation and graphical or other illustrations necessary to support his/her interpretations, conclusions and recommendations.

h) Background water quality and level information from survey area well supplies and surface water bodies.

i) Recommendations should include but not be limited to:

- Plan to overcome forecast interference i.e. lower pump intakes, deepen or drill new wells, limit taking, etc. including sufficient information to support feasibility of the approach.

- Monitoring plan including specific targets i.e. water level or other parameters to trigger a "Contingency Plan" which will prevent interference.

- The "Contingency Plan must establish a process for dealing with validation and resolution of interference claims and include details for ensuring continuity of affected supplies i.e. interim and permanent; including feasibility costs and proposals for "Financial Assurance".

LOW RISK OF INTERFERENCE

A water taking may be considered to have a low risk of interference when:

a) The separation distances from close wells are significantly beyond the radius of influence expected to be produced by the quantity of the taking.

APPENDIX B

COMBINED MINISTRY
AND
PROPONENT'S CHECK LIST FOR SUBMISSIONS

COMBINED MINISTRY AND PROPONENT'S CHECK LIST FOR PERMIT TO TAKE WATER APPLICATIONS REQUIRING A CERTIFICATE OF APPROVAL FOR A COMMUNAL WATER SUPPLY

Project Name: _____

Location: _____

Submitted by: _____

Date: _____

	Proponent's Checklist Yes	No	Ministry Check
Covering letter to Approvals Branch with copies to District Office and Regional Technical Assessment Section listing material submitted is provided	___	___	___
Submission to Region includes:			
Completed, signed, current PTTW application form	___	___	___
Completed, signed, application for Certificate of Approval	___	___	___
Location Map	___	___	___
Engineering design brief	___	___	___
Hydrogeological information that includes:			
Background information on surface water bodies, wells (recorded and unrecorded) and general hydrogeological setting	___	___	___

	Proponent's Checklist Yes	No	Ministry Check
Hydrogeological information on test drilling	___	___	___
Well construction and testing information including discussion on potential interference	___	___	___
Complete water quality analysis (chemical and bacteriological) and proposed treatment	___	___	___
Proposed Monitoring Program and Contingency Plan	___	___	___
Proposed amount of taking in Design Brief is identical to amount on PTTW application	___	___	___

Comments:

THE FOLLOWING IS FOR MINISTRY USE ONLY

Application for PTTW screened as complete Yes ____ No ____

Initial screening completed by _____ on _____, 199__.

Application forwarded/returned to _____ on _____, 199__.

Technical evaluation to be completed by _____, 199__.

Additional information required Yes ____ No ____

If yes, date returned to proponent _____, 199__.

Permit To Take Water issued on _____, 199__.

Permit No. _____

Comments:

COMBINED MINISTRY AND PROPONENT'S CHECK LIST FOR PERMIT TO TAKE WATER APPLICATIONS REQUIRING A CERTIFICATE OF APPROVAL OTHER THAN A COMMUNAL WATER SUPPLY

Project Name: _____

Location: _____

Submitted by: _____

Date: _____

	Proponent's Checklist Yes	No	Ministry Check
Covering letter to Approvals Branch with copies to District Office and Regional Technical Assessment Section listing material submitted is provided	___	___	___
Submission to Region includes:			
Completed, signed, current PTTW application form	___	___	___
Completed, signed, application for Certificate of Approval	___	___	___
Location map	___	___	___
Hydrogeological information that includes:			
Background information on surface water bodies, wells (recorded and unrecorded) and general hydrogeological setting	___	___	___

	Proponent's Checklist Yes	No	Ministry Check
Hydrogeological information on test drilling and pump testing, location and construction details of recovery and recharge wells, discussion on potential interference	___	___	___
Water quality analysis	___	___	___
Proposed monitoring program and Contingency Plan	___	___	___
Report on treatment for discharge including method, location and potential impact	___	___	___

Comments:

THE FOLLOWING IS FOR MINISTRY USE ONLY

Application for PTTW screened as complete Yes ____ No ____

Initial screening completed by _____ on _____, 199__.

Application forwarded/returned to _____ on _____, 199__.

Technical evaluation to be completed by _____, 199__.

Additional information required Yes ____ No ____

If yes, date returned to proponent _____, 199__.

Permit To Take Water issued on _____, 199__.

Permit No. _____

Comments:

APPENDIX C8

Guideline For Applying 15-08 To Large Subsurface Disposal Systems

COMBINED MINISTRY AND PROPONENT'S CHECK LIST FOR PERMIT TO TAKE WATER APPLICATIONS NOT REQUIRING A CERTIFICATE OF APPROVAL UNDER THE OWR ACT

Project Name: _____

Location: _____

Submitted by: _____

Date: _____

	Proponent's Check Yes	Proponent's Check No	Ministry Check
Completed, signed PTTW application	___	___	___
Copy of water well record(s) for production well(s)	___	___	___
Location map showing all required information	___	___	___
Water well records and data for all local wells	___	___	___
Pump test data including change in water levels and recovery time	___	___	___
Pump test conducted at maximum design rate	___	___	___

If the Ministry deems the proposed water taking could represent a greater than low risk of interference situation, then the following information is to be included.

	Proponent's Check Yes	No	Ministry Check
Detailed pumping test information	___	___	___
Assessment of interference potential	___	___	___
Proposal to alleviate potential interference	___	___	___
Monitoring Plan	___	___	___
Contingency Plan	___	___	___

Comments:

THE FOLLOWING IS FOR MINISTRY USE ONLY

Application for PTTW screened as complete. Yes ____ No ____

Initial screening completed by _____ on _____, 199__.

Application forwarded/returned to _____ on _____, 199__.

Technical evaluation to be completed by _____, 199__.

Additional information required Yes ____ No ____

If yes, date returned to proponent _____, 199__.

Permit To Take Water issued on _____, 199__.

Permit No. _____

Comments:

8LSSDS.GL
Feb.3, 1992.

GUIDELINE FOR APPLYING POLICY 15-08 TO LARGE SUBSURFACE SEWAGE DISPOSAL SYSTEMS

This Guideline should not be used without consultation with Staff of the Ministry of the Environment.

Working Group V
Water Management Steering Committee

February 3, 1992

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FOR DISCUSSION ONLY

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GUIDELINE FOR APPLYING POLICY 15-08 TO LARGE SUBSURFACE SEWAGE DISPOSAL SYSTEMS

1.0 INTRODUCTION

Ministry Policy No. 15-08, ("The Incorporation of the Reasonable Use Concept into the Ground Water Management Activities of the Ministry of the Environment," Water Management Steering Committee, Working Group V), the "Reasonable Use" Policy, establishes procedures for limiting the amount of contaminant discharge to the ground water. It limits discharges to a level that the Ministry of the Environment considers to be acceptable; a level that will have no more than a negligible effect on the present or potential use of the Adjacent Property. This is discussed in detail in the Policy. The Policy applies to activities requiring a Certificate of Approval under Ministry of the Environment legislation. This includes Large Subsurface Sewage Disposal Systems, as defined in Notice 3/87, July 15, 1987. This Guideline addresses the application of Policy No. 15-08 to Large Subsurface Sewage Disposal Systems (referred to as Large Systems in the remainder of this document).

In most of Ontario, the Director under Part VII of the Environmental Protection Act, is designated staff of the local Health Unit. In the remainder of the Province, designated staff of the Ministry of the Environment will be the Part VII Director. In this document, unless otherwise noted, "Director" means the Director responsible for administering Part VII, his staff or his advisors; either in the Health Unit or in the Ministry of the Environment. The Health Unit Director will consult with the Ministry of the Environment Director to resolve problems associated with the application of Policy 15-08.

As noted in Policy 15-08 (Section 2.4, C), there are some practical differences in the hydrogeologic aspects of solid and liquid waste disposal facilities. These differences are associated with monitoring (the initiation and appearance of contaminant discharge) and contingency measures (the removal of the waste or the source of contamination). They will allow less rigorous measures for groundwater protection from Large Systems without appreciably increasing the risk of long term environmental damage.

Because of these differences, the requirements of the Guideline are relatively liberal and assumptions have been made that may not always apply (see Section 4.0 f). This approach has been taken to minimise interference with development, to allow a maximum amount of professional discretion on the part of applicants and to facilitate the testing of innovative servicing alternatives and new technology(see Section 4.0, h). However, even where the Guideline has been followed, if there is a system failure, and the limits imposed by Policy 15-08 are exceeded, it is the responsibility of the applicant or the owner of the system to rectify any problems

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that have developed in accordance with Policy 15-10 "The Resolution of Groundwater Quality Interference Problems" or the conditions of the Approval.

This Guideline is intended for use by Ministry staff or by a proponent in consultation with the Ministry. This consultation is essential because some aspects of a proposal, such as the scope of the investigation, monitoring, contingency plans etc. are decided on a case-by-case basis. The document is intended for use by professionals who routinely undertake this type of work and are competent in hydrogeology.

2.0 APPLICATION OF THE GUIDELINE

Neither this Guideline nor Policy 15-08 are considered to apply to the impact of isolated individual residential units or interference between individual home systems on neighbouring lots within a proposed subdivision. It is considered that any problems associated with such systems are adequately addressed by other Ministry advice and requirements. Questions on these systems may be referred to the local Health Unit or the Regional or District Office of the Ministry of the Environment.

As indicated in Part c) of the definition in Notice 3/87, this Guideline applies to the cumulative or total impact of a subdivision of more than five individual systems, at the boundary of that subdivision. (Note, however, that the required approvals are not for the subdivision but for the individual units. These are dealt with in the "Manual of Policy, Procedures and Guidelines for Onsite Sewage Systems"). It is not considered necessary to formalize some sort of pre-approval for planned clusters of individual units. It seems sufficient to make our position widely known and to object strenuously, if the need arises, when planning approvals are being sought. When the Director comments on draft subdivision plans he should recommend to the Municipal Board that the developer be required to meet the requirements of this Guideline to the extent possible. These may impose controls on a developer, for perhaps a decade after a subdivision has been completed.

It is not considered appropriate to apply this Guideline retroactively and it will not be applied to applications for approval of subsurface systems which are a replacement due to the failure (i.e. hydraulic load, age, etc.) of the original system, providing that the replacement system does not service any more facilities than the failed system. (Note: Where failure has resulted in unacceptable contaminant discharges, it should be handled in accordance with Ministry Policy 15-10, "The Resolution of Groundwater Quality Interference Problems")

3.0 CONDITIONS FOR APPROVAL/COMPLIANCE

Conditions for approval/compliance of Large Systems are as follows:

3.1 Condition 1

Except under the circumstances described in Sections 3.2 and 3.3, a complete hydrogeologic study, ground water monitoring and Financial Assurance, as discussed below, and in Appendix A-1 and Appendix A-2 to this Guideline, will be required or recommended for all Large Systems. Because of the uncertainty in calculations of contaminant travel and attenuation, monitoring is almost always necessary. Contingency measures, in the form of Financial Assurance are a necessary companion to monitoring.

3.1.1 Hydrogeologic Study and Ground Water Monitoring

The hydrogeologic study and the ground-water monitoring will determine the impact of the Large System on the ground water at the site (or subdivision) boundary in accordance with Policy 15-08. Please note that this hydrogeologic study is not the assessment described in Chapter 6, Chapter 8 (Article 8) or Chapter 14 (Article 8) of the "Manual of Policy, Procedures and Guidelines for On-Site Sewage Systems". The assessments described in the Manual are those assessments necessary to determine the hydraulic capability of the soil to disperse effluent from a leaching bed on a continuous basis, and do not take into account the potential for contamination of the groundwater. However, the hydrogeologic study required for an assessment of a site relative to Policy 15-08 can be expanded to include an assessment of the hydraulic capability of the soils to absorb the effluent from a leaching bed on a continuous basis as described in the manual.

(a) The Critical Contaminant - In calculating the impact of the Large System at the site boundary in systems treating only domestic/household sewage, total nitrogen, converted to nitrate, may be considered as the Critical Contaminant (as defined in Policy 15-08, Section 3.5.1.3). If the system is treating any other waste (e.g. slaughter-house waste, brewery waste) or contains substantial quantities of non-domestic/household sewage (i.e. commercial condominiums, restaurants, institutional buildings etc.), it will be the responsibility of the proponent to identify the critical contaminant and its concentration. (Note: It is recognized that trace organic and other contaminants may be present in septic effluent and that one of these may ultimately prove

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to be the critical contaminant.)

As in the assessment of landfills, confirmation of the Critical Contaminant will be achieved through the monitoring program.

(b) Impact Prediction - For the purposes of calculating site impact, the Ministry will accept average effluent flow values corresponding to 1000 l/day per dwelling unit for residential development. For installations other than residential development, effluent flow values corresponding to the design flow values contained in Appendix 9.3.1 of Chapter 9 in the "Manual of Policy, Procedures and Guidelines for Onsite Sewage Systems" will be accepted. In dealing with domestic waste effluent, unless there is specific evidence to the contrary a value of 40 mg/l for nitrate nitrogen in the discharge from a Class 4 or Class 6 System, treating domestic/household sewage, will be acceptable to the Ministry. Unless there is evidence to the contrary, the "uncontaminated " background, as defined in Section 3.5.1.1 of Policy 15-08, for nitrate nitrogen will be assumed to be no greater than 2 mg/l.

Where nitrate nitrogen is the Critical Contaminant, a level of 10 mg/l will be acceptable for the initial estimate of impact at the site boundary. This would only apply where dilution is considered to be the only attenuation mechanism. This is for the purpose of calculation only. It recognises that hydrogeologic calculations are generally conservative and assumes that additional attenuation would be available and will be adequate to protect adjacent property.

With respect to nitrate, three attenuation, mechanisms should be considered; dilution by dispersion in the groundwater flow system, dilution in the well caused by mixing contaminated and uncontaminated water in the cone of capture, and denitrification. Ongoing research at the Institute for Groundwater Research at the University of Waterloo in Waterloo Ontario, is indicating that dispersion and denitrification are very weak attenuation mechanisms in contaminant plumes from individual septic systems in sand deposits. If the results of this research hold, it is anticipated that few individual Large Systems that rely heavily on attenuation in the groundwater in sand deposits will be able to meet the requirements of Policy 15-08. It is expected that this will also apply to Large Systems that rely on attenuation in fractured rock.

It is strongly advised that applicants keep abreast of current research in this field and apply it to estimates of

contaminant attenuation. As noted in Section 1.0, system failure must be rectified by the owner and therefore both a conservative and a current approach is advisable. (see also Section 4.0,f)

(c) Monitoring Ground Water Quality - The initial groundwater monitoring shall include nitrate, nitrite, total Kjeldahl nitrogen, ammonia, conductivity, total coliform, sodium, and chloride.

(d) Other Ground Water Monitoring - Other aspects of the monitoring, such as water levels, the location of installations, specific contaminants that may be of interest or associated with a particular Large System, and sampling frequency, are site specific and should be addressed on that basis by the applicant in his submission to the Director.

3.1.2 Financial Assurance

Financial Assurance, as defined in Part X-A of the Environmental Protection Act, shall be provided to pay for contingency measures until groundwater monitoring can demonstrate that the Large System is functioning as designed and meets the requirements of Policy 15-08. Detailed information on Ministry requirements for financial assurance, the preparation of cost estimates, administration of financial assurance, etc. are provided in "Guidelines for Financial Assurance: (Part X-A), Ontario Environmental Protection Act" by the Policy and Planning Branch, (now the Fiscal Planning and Economic Analyses Branch), Ontario Ministry of the Environment, February 1988. Sections 3, 4, and 5 and Appendix A are particularly relevant. Questions on this aspect of these Guidelines may be referred to the Fiscal Planning and Economic Analyses Branch. Please note that the advice given in this Guideline applies to Large Systems and may not apply to other activities requiring Financial Assurance.

(a) Termination of Financial Assurance - Specific criteria for demonstrating that a Large System is functioning properly, shall be proposed by the applicant on a case-by-case basis, and are subject to the written approval of the Director. These criteria will generally be based on a predictive monitoring program that specifies monitoring results, (eg. nitrate levels in specific boreholes at specific times). When, based on these criteria, it can be shown that the Large System will meet the requirements of this Guideline and Policy 15-08, the fund may be terminated.

(b) The Amount of Financial Assurance - Considerations in determining the size of the Financial Assurance fund would

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include, the environmental consequences of failure, the potential cost of clean-up, and the potential cost of alternate methods of sewage disposal including conversion to more efficient treatment systems or to a municipal service. It will be up to the proponent to address these considerations in detail to justify his estimate of the proper size of the fund. Ministry Policy 15-10, "The Resolution of Ground Water Quality Interference Problems", by the Water Management Steering Committee, Working Group V, may be useful in addressing costs associated with the resolution of potential ground-water contamination problems.

3.2 Condition 2

A complete hydrogeologic study, ground-water monitoring or Financial Assurance as described in Condition 1 may not be required where the large System is a Part VII system treating domestic waste, and any one of the following circumstances can be shown to be present:

3.2.1 Located on Protective Surficial Deposits

Where it can be demonstrated by the applicant to the satisfaction of the Director, that;

a) unconsolidated earth materials whose saturated hydraulic conductivities are 10^{-5} cm/sec. or lower comprise the top 10 m of the surficial materials at the site, and

b) that these deposits are likely to be laterally continuous for at least 100 m, and do not contain significant lenses or beds of higher hydraulic conductivity materials, that exceed one meter in cumulative or total thickness, that would serve as practical sources of groundwater to wells, or impair the function of the earth materials as a barrier to contaminant migration.

The Director will accept the fact that the Large System is located in Area Five on Map S100, as whole or partial evidence that the System is located on protective surficial deposits. Because this is a regional map and may be unreliable in some areas, the weight given to this evidence will be judged on a case-by-case basis. Map S100, "Hydrogeologic Environments and the Susceptibility of Groundwater to Contamination", was prepared by the Water Resources Branch of the Ministry of the Environment. Copies may be obtained from that Branch.

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3.2.2 Adequate Lot Size

For sub-divisions (as defined in Notice 3/87) only, where the lot size for each private residence in the subdivision is 1 ha or larger, the risk that the limits imposed by Policy 15-08 at the subdivision boundary will be exceeded by individual systems on 1 ha lots is felt to be acceptable. It is assumed that precipitation on a 1 ha lot, dilution in the well bore and denitrification will be sufficient to reduce the nitrate nitrogen to an acceptable concentration in wells on the Adjacent Property.

3.3 Exemptions and Requirements at the Discretion of the Director

Requirements or recommendations for hydrogeologic studies and/or ground-water monitoring and/or Financial Assurance may be imposed or exempted in cases specifically identified by the Director, even though the conditions defined in Conditions 1 and 2 are met. The reasons for this include:

a) There is evidence that other similar facilities in that environment or area have functioned properly or have failed;

b) The distribution of individual systems in a subdivision does not allow sufficient attenuation of contaminants. (It should be noted that it will be necessary to know the locations of septic systems within a subdivision to address the impact of these systems at the subdivision boundary);

c) Because of current and potential land uses, special exemptions or additional requirements would be justified (see Section 4.0, c);

d) Because of other reasons that would be specified by the Director.

Justification for such exemptions or requirements must be demonstrated by the applicant or other interested parties to the satisfaction of the Director.

4.0 GENERAL COMMENTS

a) Applicants may wish to arrange to meet with the Director, or his staff, before preparing a submission and before undertaking a commitment to construct a Large System. At such a meeting the Director will provide regulatory advice but cannot provide professional or technical instruction.

b) Factors that the applicant may wish to consider in preparing

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a work plan include:

i the Reasonable Use of the groundwater,

ii the scope of any hydrogeologic investigation that may be necessary and the assessment of the impact of the System,

ii a preliminary position on the suitability of any monitoring and the amount of any Financial Assurance,

iii the possibility of environmental assessment requirements,

v the subsurface discharge of contaminants into surface water,

vi the optimum location and orientation of leaching beds,

vii possible use of a Contaminant Attenuation Zone,

viii the use of new technology (e.g. treatment systems to reduce the nitrate concentration in the effluent), and,

ix the potential that a municipal or communal system might be forthcoming.

c) It is the responsibility of the Ministry of the Environment Regional Director to decide (based on the submission of the applicant and the advice of staff) the "Reasonable Use" of the ground water on a case-by-case basis. In areas where nitrate (or other contaminant) levels are being elevated substantially by agricultural activities and/or urban development, under some circumstances, and perhaps for a stipulated period of time, he may wish to consider a "Reasonable Use" of the ground water to be to assimilate nitrate from a Large System and not for drinking. There may even be circumstances where a Large System will contribute less contamination than a previous or alternate land use, resulting in a net improvement in groundwater quality.

The Ministry of the Environment Regional Director may also have to judge Reasonable Use in other environments where the groundwater is not now and is not likely to be used for drinking. These would include those in which the water is saline and those where the earth materials would not yield useful amounts of water to wells.

The Ministry of the Environment Regional Director would also

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Attenuation Zone, (Policy 15-08, Section 3.3.2) be allowed to extend the area in which contaminants from the Large System can be attenuated

d) Other documents that should be used in conjunction with this Guideline include:

Advice to Applicants and to Consultants in Preparing Reports for Proposed Landfill Sites. (Water Management Steering Committee, Working Group V);

Manual of Policy, Procedures and Guidelines for Onsite Sewage Systems. (Ministry of the Environment);

Class Environmental Assessment for Municipal Sewage and Water Projects (Municipal Engineers Association), and M.O.E. Class Environmental Assessment Document, Expansion or Upgrading of an Existing Sewage or Water System. (Ecologistics Limited).

e) In view of the relative ease of monitoring, the nature of the contaminants and the option of decommissioning or redesigning the Large System as a contingency measure, a less comprehensive hydrogeologic assessment will be required for these Large Systems than is required for landfills. It is critical however that this assessment, be sufficiently detailed to allow the design and installation of an effective monitoring system. The scope of this assessment will be addressed through consultation with the Director.

f) It is recognized that the assumptions that are required for allowing a level of 10 mg/l to be used in the initial calculation of site impact(Section 3.1.1,b), for exempting lots of 1 ha (Section 3.2.2), for using nitrate as the critical contaminant etc. cannot be technically supported on a case by case basis. As noted in Section 3.1.1,b), the results of the current research at the University of Waterloo indicate that in sandy deposits dispersion and denitrification in contaminant plumes from septic systems is much less than expected. If similar results are obtained in less sensitive hydrogeologic environments substantial revision of this Guideline may be necessary. However the net cast by this Guideline is felt to be adequate, at least for the present, to reduce the risk of environmental damage from Large Systems to acceptable levels. Although the Director may support a proposal for a Large System, and permit its installation, he does not bear responsibility for failure of the Large System, for correcting damage to adjacent properties or for the construction of a new waste-disposal system. This is the responsibility of the proponent/owner of the system.

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g) As explained in Section 1.0, this Guideline is intended to protect ground-water quality and thus will favour sites located in environments in which the surficial deposits have low, hydraulic conductivities. In such environments careful design will be required to avoid surface-water contamination and/or surface breakout.

h) The use of an innovative servicing technology or new technology will be closely scrutinized by the Ministry in accordance with the procedures detailed in Notice 5/83 "Assessment of New Methods, Equipment and Products for use in the Private Sewage Program under Part VII, Environmental Protection Act". Consideration will be given to the potential impact on the environment that could result from failure of new or innovative technology and monitoring and Financial Assurance may be required by the Director (Section 3.3, d).

i) This Guideline is not intended to serve as a mechanism for controlling or prohibiting Large Systems in particular areas or regions that may be identified as hydrogeologically vulnerable to contamination and as containing particularly significant groundwater resources.

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conditions, (i.e., stability and acceptable limits) have been demonstrated, monitoring programs can be terminated and contingency plans dropped.

3.5 Predictive Monitoring

Predictive monitoring will generally be required by the Ministry. To meet this requirement the applicant must predict, by technically accepted means, the level contamination that is anticipated to be present in various monitoring installations at various time intervals.

The Ministry recognizes that to make an accurate prediction of contaminant levels and trends prior to actual disposal is beyond the limits of our present technology. However, it is always possible to provide estimated values. Comparison of the predicted and the actual values obtained from the monitoring program will allow the Ministry to judge the level to which the hydrogeologic system at the site is understood. A secondary benefit of predictive monitoring is that it necessitates the routine collection and assessment of incoming monitoring data and an organized periodic review of the monitoring results.

In conjunction with providing a prediction of the contaminant levels and their trends in various monitoring wells, the applicant should also specify:

a. the levels of contaminants in particular wells which would indicate that the design of the Large System may fail, and,

b. the triggering levels which would activate various contingency activities.

3.6 Construction of Monitoring Installations to Measure Off-Site Impact

As discussed in Section 2.2, the subsurface unit(s) that must be protected to meet the requirements of the "Reasonable Use" policy must be identified by the applicant. Groundwater monitoring data at or near this unit(s) will be required in order to determine if the site is meeting these requirements. The following points should be noted.

1. Although the Ministry may not judge the acceptability of a contaminant discharge on the basis of contaminant levels in the most contaminated unit in the subsurface, it will generally be necessary for monitoring wells to be placed within those units in the groundwater flow system where it is expected that the contaminant plume will have its greatest impact on groundwater quality.

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2. In most cases subsurface units should be monitored with individual "aquifer specific" wells. However, where the hydrogeologic system is complex, monitoring wells with relatively long screens and sand packs crossing a series of thin permeable units may be appropriate and water quality data may be "averaged" in this manner.

3. Monitoring wells require particularly careful positioning in fractured media in order to properly assess the impact of the Large System.

4. The possibility of hydraulic connection between aquifers within and beyond the boundary of a Large System should be considered in the location and construction of site boundary monitoring wells.

4.0 SAFETY MARGINS

Section 2.4,B of the "Reasonable Use" document, Policy 15-08, discusses the need for establishing a safety margin to account for uncertainty in the estimate of contaminant discharge and the consequences of failure of a waste disposal facility. As explained in Section 1.0 of the Guideline (Appendix A), less rigorous measures can be taken for groundwater protection from liquid then from solid waste disposal facilities. However, particularly where a monitoring plan and Financial Assurance are not required, consideration may be given to the establishment of a safety margin in a proposal for a Large System.

Factors that may be considered include:

a) the accuracy of the calculation,
b) the value of the resource,
c) the consequences of failure, and,
d) the characteristics of the waste, and the contaminants that are produced.

The establishment of safety margins will make it more difficult for applicants to obtain Ministry support for sites in environmental settings that are difficult to assess, or where failure will have serious environmental consequences.

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APPENDIX - A1

SUGGESTIONS FOR THE ASSESSMENT AND MONITORING OF OFF-SITE IMPACT FOR PROPOSED LARGE SYSTEMS.

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SUGGESTIONS FOR THE ASSESSMENT AND MONITORING OF OFF-SITE IMPACT FOR PROPOSED LARGE SYSTEMS.

1.0 SCOPE AND INTENT

This Guideline (Appendix A) is a support document to Ministry Policy No.15-08: "The Incorporation of the Reasonable Use Concept into the Groundwater Management Activities of the Ministry of the Environment", September,1986. The "Reasonable Use" policy limits contaminant discharge from disposal sites to levels that the Ministry considers to be acceptable and addresses the need for incorporating monitoring plans and contingency plans into proposals for disposal sites. This Guideline addresses only the protection of existing or potential groundwater supplies.

This Guideline was prepared for the use of Ministry staff, experienced in hydrogeology, who are routinely involved in the assessment of proposals for Large Systems and applicants in consultation with Ministry staff. It is therefore considered an Internal Guideline. It presents the Ministry views on the various procedures that might be followed in assessments and the issues that should be addressed. It is not intended as an instruction or design manual, but assumes a working knowledge of hydrogeology and an understanding of related Ministry policy and guidelines.

The Guideline addresses performance or results rather than methodology. For example, the information that must be gathered by a monitoring plan, or its objectives, are specified by the Ministry, but the number of monitoring installations that would be required to gather this information should be determined by the applicant. The Ministry cannot specify a minimum number of bore holes, water quality samples, etc., that would apply to all sites. Variations in hydrogeology are too great to permit this approach. Instead, judgements will be made on a case-by-case basis in accordance with the advice presented in this and other relevant Ministry policies and guidelines.

Guidance on the scope and sophistication of the site investigation will be provided on a case-by-case basis by Ministry personnel in discussions with an applicant. The Ministry may not always agree with the applicant's prediction of environmental impact. In such cases, such a proposal may be accepted if significant environmental damage will not result and the applicant provides a monitoring plan that will support the prediction and a contingency plan, with provisions for Financial Assurance, for implementation if the prediction is shown to be in error.

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2.0 THE ASSESSMENT OF OFF-SITE IMPACT

2.1 Introduction

In assessing a proposed disposal site, or a site wishing to expand, a proponent must provide an estimate of potential contaminant discharge that shows that the contamination from the site will meet the limits specified by the "Reasonable Use" Policy. Three basic steps are required to make this estimate. These are:

1. to identify the subsurface unit or units that must be protected in order to meet the requirements of the Reasonable Use Policy; (This document is concerned only with the protection of groundwater. Advice on the protection of surface water, utilities, etc., should be obtained on a case-by-case basis from Regional staff.)

2. to identify the particular contaminant(s) that is of most concern (i.e., the "critical contaminant"); and

3. to estimate the maximum impact of the critical contaminant on the unit(s) identified in (1) above.

The following discussion presupposes that an adequate understanding of groundwater flow at the site has been achieved. Flow path analyses must be completed before a useful estimate can be made of the impact of contaminant discharge on the groundwaters.

2.2 The Identification of the Subsurface Unit or Units that Must be Protected

As indicated in the "Reasonable Use" policy, the Ministry objective is to protect the present and potential reasonable uses of groundwater on adjacent property (i.e. reasonable sites for water wells that will produce water meeting the Reasonable Use limits). To accomplish this, the groundwater resource and its uses must be described and the means used to obtain this resource must be understood. The applicant should determine the distribution and characteristics of the subsurface unit(s) that yield water, the quality and quantity of the groundwater that is produced or could be produced, the present and potential uses of this groundwater resource, and the types of wells that are commonly used or would reasonably be expected to be used to develop this resource.

Based on the assessment of these factors, the applicant should identify the subsurface unit(s) that constitute the water resource and would have to be protected in order to meet the

requirements of the "Reasonable Use" policy.

In most cases, the water resource that is to be protected will begin at the site boundary or the boundary of a Contaminant Attenuation Zone. However, in some cases, the presence of highways, streams, topographic constraints, etc., may indicate that the water resource to be protected is at some distance from the site boundary.

The estimate of off-site impact and the development of the monitoring program require this identification. This is discussed further in Sections 2.4 and 3.0.

There are also a number of other factors that should be considered in determining the unit(s) that must be protected in the vicinity of a proposed large system. These are as follows:

1. The Ministry of the Environment will not necessarily judge the acceptability of a contaminant discharge on the basis of contaminant levels in the most contaminated unit in the subsurface unless these levels will impair the present or potential Reasonable Use of that water resource.

2. Ontario Regulation 612/84 pertaining to water well construction applies primarily to the construction of new wells and cannot be used to require owners to modify older domestic wells; only to maintain them. The importance of this facet of the regulation is that it will not allow consideration to be given to requests that the Ministry have well owners redrill or replace their well supplies in order to allow an increase in contaminant levels at the waste disposal boundary.

3. The following requests will only be considered by the Minister of the Environment in the most exceptional circumstances:

   a. Requests to designate aquifers as sole source (the only practical source of water) to enforce more stringent well construction design practices beyond those provided in O.R. 612/84, or,

   b. Requests to restrict development to specific aquifers in order to accommodate or permit off-site aquifer contamination.

2.3 The Selection of the Critical Contaminant

The critical contaminant in a contaminant plume is the particular contaminant which has reached, or has the greatest potential to reach unacceptably high levels at a point of potential

groundwater use. In order to determine if the Large System will comply with Ministry limits on contaminant discharges, the critical contaminant must be identified and its concentration in the unit(s) that must be protected must be estimated. This is the responsibility of the applicant. As addressed in Section 3.1.1 a) of the Guideline, in systems treating only domestic/household sewage, total nitrogen, converted to nitrate, may be considered as the Critical Contaminant. Where other wastes are involved, the following should be considered.

1. Where a critical contaminant is particularly difficult to sample or to analyze, it is acceptable to monitor a related indicator contaminant that can be shown to vary directly as the critical contaminant.
2. Some persistent contaminants are unacceptable in the environment at concentrations as low as a few micrograms per litre or less. Where such contaminants are present in wastes, even if in very small amounts, it will be very difficult to find sites for Large Systems where attenuation is adequate. Under these circumstances other methods of disposal should be considered.
3. It may facilitate a site assessment and allow the early rejection of unsuitable sites or wastes if the applicant first makes a preliminary estimate of the amount of attenuation that will be required to reduce the concentration of the critical contaminant to acceptable levels. It may then be a relatively simple matter to determine if the prospective site is likely to provide this amount of attenuation, or to judge if the particular waste is amenable to disposal in a Large System.

2.4 Methods of Estimating the Impact of Contaminants

2.4.1 Introduction

The state-of-the-art is such that the Ministry cannot rely solely on a prediction of contaminant levels in assessing the suitability of a proposed large system. There must also be monitoring programs and Financial Assurance to ensure the protection of the environment. However, despite their lack of certainty, quantitative estimates of potential contaminant levels are useful and necessary in a site assessment.

This Section addresses methods that can be used to estimate the impact of a large system. It is divided into three parts. The first part deals with methods for estimating contaminant attenuation resulting from hydrodynamic dispersion or dilution (ie. mixing groundwater that has been contaminated with groundwater that has not been contaminated), the second part deals with methods for estimating the attenuation of reactive solutes, and the third part provides some general comments on estimating site impact.

2.4.2 Methods of Estimating Attenuation that Results from Hydrodynamic Dispersion

Several approaches can be used to estimate potential attenuation resulting from hydrodynamic dispersion at a proposed site. The approach, or approaches, that are used will depend on the particular site and the availability of data. Some of the approaches that can be considered are:

1. An estimate, based on mixing groundwater flowing under the Large System with contaminated groundwater produced by the Large System. The estimate can be based on consideration of advective, dispersive and diffusive processes along flow paths;

2. An estimate based on comparing the amount of water that is recharged in the areas upgradient and downgradient from the Large System with the contaminated groundwater produced by the Large System. This would be accomplished by comparing these areas to that of the Large System and considering their relative infiltration rates;

3. Assuming the same amount of hydrodynamic dispersion or mixing that is provided by a site in a similar hydrogeologic setting will be provided at the site that is being assessed.

The first approach requires, among other things, estimates of hydraulic conductivity and/or dispersivity and will, therefore, yield estimates of attenuation which, even in sophisticated assessments, could be in error by as much as 5 times.

In using approaches one and two a non-conservative maximum amount of attenuation will be calculated if complete mixing in the aquifer is assumed. It is recognized that dispersion cannot always be properly considered. This is particularly significant in the assessment of subdivisions that are Large Systems.

The third approach, although potentially the most accurate, is an empirical approach and should be used with caution. This approach should generally be used in conjunction with approach one or two. It will require information on site history, detailed hydrogeologic conditions and historical data on the contamination that may be difficult to obtain.

It is better to determine this attenuation factor from a stable plume which has been clearly described. Comparison of concentration versus travel distance from several points along a flow path in such a plume will allow some understanding of the reliability of the estimate.

Where possible, several methods of calculating the attenuation

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that results from hydrodynamic dispersion should be used on each site. A range of the possible amounts that might be expected to occur should be provided in the applicant's proposal and the results compared and discussed.

2.4.3 The Attenuation of Reactive Solutes

This section addresses the attenuation of contaminants by mechanisms other than by hydrodynamic dispersion. The attenuation of reactive solutes can be estimated by:

1. Assuming the same amount of attenuation that is provided by a site in a similar hydrogeologic/ geochemical setting will be provided at the site that is being assessed.

2. Estimating attenuation based on reactive solute models and values of various parameters from the literature.

Estimates based on measurements from a site in a similar hydrogeologic/geochemical setting, from a nearby Large System, are considered to be more reliable than estimates based on measurements from other sites or in laboratory tests recorded in the general literature.

Predictive mathematical modelling of reactive transport has the potential for a high degree of error, and estimates of attenuation based on this method of assessment are not acceptable unless they incorporate an appropriate margin of safety or they are strongly supported by a proper site assessment. Models are addressed in Appendix A-2.

2.4.4 General Comments

1. In reviewing hydrogeologic assessments, it is important to ensure that the data form a part of a coherent pattern in a well understood hydrogeologic system.

2. In order to estimate the impact of a proposed Large System on the groundwater resource beneath the adjacent property, it is necessary to calculate the flux of contamination through a subsurface unit(s) that has been carefully selected to most accurately reflect the impact of the site on this water resource. The unit(s) that is selected for this purpose will generally be identical to that identified in Section 2.2. However, where appropriate, a simplified approximation of the same unit(s) may be used for the purposes of this estimate. In making this estimate it is not acceptable to assume that the entire thickness of an aquifer is available for diluting contaminants if nearby wells only draw from a fraction of the thickness of that aquifer unless it is demonstrated that contaminants are mixed throughout the thickness of the aquifer. Examples of

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simple cases are provided in Figures 1 and 2.

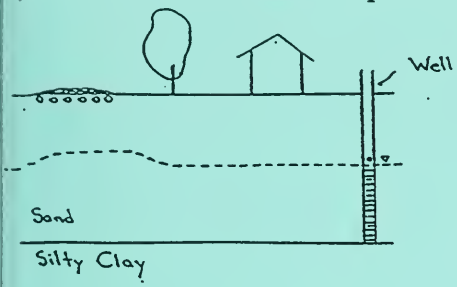

Figure 1

Domestic wells are generally completed in a five metre thick surficial sand. Consider mixing in the saturated thickness of the sand.

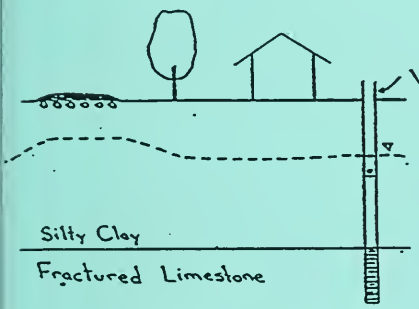

Figure 2

Domestic wells are generally completed in the top six metres of a uniformly fractured carbonate bedrock, although the top 20 metres of the bedrock are productive. In the absence of firm evidence to the contrary, consider mixing in the silty clay and only the top six metres of the bedrock.

As the hydrogeology becomes more complex, as, for example, in Precambrian terrains, or in thick sequences of ice contact deposits, it becomes more difficult to select the proper subsurface units on which to base the estimates of safe impact. Where uncertainty is present, it is suggested that it be resolved by consultation between the Director and the proponent.

3. Mathematical modelling techniques (Appendix A2) can be used as a tool to help estimate hydrodynamic dispersion and the attenuation of reactive solutes. In particular, rather than assuming a simple case with complete mixing in an underlying aquifer or part of the aquifer, modelling will facilitate the incorporation of dispersion into the estimate for a more sophisticated result. This will almost always be necessary when dealing with subdivisions that are Large Systems.

Since models must incorporate assumptions to obtain a manageable solution, the usefulness of such methods for actual predictive estimates is limited. The appropriateness of the models and the assumptions will be considered on a case-by-case basis. The Ministry supports the use of

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reactive contaminant modelling as a part of a predictive monitoring program, but is of the opinion that such models are not reliable unless they are calibrated and verified with ongoing data from the monitoring program. Thus, as previously explained, the Ministry would consider their value limited in a proposal for a new site.

It should be noted that the benefits of any additional accuracy that may be obtained through the use of a sophisticated model may not be warranted, particularly at sites where less complex methods may demonstrate clearly that the proposal is or is not viable.

4. In all calculations, possible sources of error should be documented and discussed and some type of "worst case" estimate should be provided. It may be useful to conduct sensitivity analyses by varying the values of the parameters used in the calculations. Calculations should also consider potential changes in groundwater flow brought about by seasonal influences and by off-site groundwater development.

5. A simple estimate of the amount of attenuation by mixing that contaminants from the Large System will undergo on entering a watercourse can be made by comparing the surface area of the drainage basin up stream from the point at which the contaminants will reach the surface waters, to the area of the Large System. In so doing, consideration should be given to the different rates and amounts of recharge through the various types of earth materials in the basin compared to the rate and amount of recharge through the Large System. In this comparison, it should usually be assumed, in the absence of data to the contrary, that there will be little or no contribution of uncontaminated water during periods of low flow from those parts of the basin where bedrock and other material with small effective porosity are at or within a few feet of the ground surface.

More sophisticated techniques will be required where the system is more complicated or where the basin divides are not easily defined.

Where contaminants from Large Systems discharge to a watercourse, Provincial Water Quality Objectives and associated policies will apply. These are presented in Ministry Policy 15-01, "Water Management Goals, Policies, Objectives, and Implementation Procedures of the Ministry of the Environment", November 1978, Revised, May 1984.

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3.0 MONITORING AND CONTINGENCY PLANS

3.1 Introduction

Most proposals to the Ministry for Large Systems must include a monitoring plan. This section outlines Ministry requirements for monitoring and provides guidance as to how these requirements may be met.

The monitoring plan is a document which details all construction, operation, maintenance and supervision for a ground or surface water observation network for the routine collection and interpretation of data to supervise a program to protect the environment. The monitoring commences after all, or nearly all, of the site exploration and assessment program has been completed.

Monitoring may range from an extensive program involving the weekly collection and analysis of water samples to perhaps no more than yearly observations.

3.2 Objectives of Monitoring Plans

The objectives of monitoring plans are as follows.

1. The monitoring plan will test the accuracy of the hydrogeologic assessment of the site (i.e., the predictions of contaminant movement into ground and surface waters) and verify the applicability of any analyses of groundwater flow and contaminant transport that may have been used. Several examples are:

    (a) The rate at which contaminants migrate and attenuate will have been estimated in the site assessment. The monitoring program will, through the collection of several years of data, be the means of testing these estimates and of providing hard data on the rate of contaminant transport and attenuation. An appraisal of these data would be compared to the original assessment and adjustments of the estimated environmental impact of the site would be made as necessary.

    (b) An applicant may have based the assessment of a site on an estimated value that the Ministry considers questionable but cannot refute. Monitoring data would be gathered during the first year or years of the operation and based on the assessment of these data, modifications would be made as necessary.

2. The monitoring plan will activate contingency measures. For example, unexpected contaminant levels in a monitoring well indicating that unacceptable contaminant concentrations may

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develop or have developed would trigger a contingency response, such as an increase in monitoring or decommissioning the Large System.

Monitoring installations must provide data that will give sufficient warning (or lead time) of impending unacceptable off-site impacts so that successful contingency measures can be implemented. The monitoring plan must, therefore, consider the configuration of the groundwater flow system as determined in the site assessment, the velocity at which contaminants will move, and the calculations of contaminant attenuation that were made in that assessment.

3.3 Development and Refinement of Monitoring Plan

The monitoring plan must be completely or almost completely developed during the site investigation. Before the Large System is approved the major aspects of the monitoring plan such as the locations, designs, and sampling protocols of the various monitoring installations should be specified and the outline of the plan should be defined. However, it may be necessary to refine some parts of the monitoring plan after the site is operating. Such refinements might include confirming the identity of the critical contaminant and the development of a tiered, long-term monitoring protocol (i.e., the frequency of sampling, the parameters to be sampled, the assessment of sampling data, and the methods by which samples will be collected). Although these subjects would be initially addressed during the site exploration program, on occasion it may be necessary to base final conclusions on the data gathered during the early stages of the monitoring program.

In most cases it is the Ministry preference to initially have an intensive monitoring program with the intent of scaling down the program as supporting data are generated.

3.4 Time Frame and Responsibility For Monitoring

The period of time over which the applicant estimates that monitoring and contingency plan activities will be conducted should be addressed and supporting data and estimates provided in the applicant's submission to the Ministry. The organization(s) responsible for assessing and carrying out these activities during this period and the amount and sources of required resources should also be identified in the applicant's proposal.

To verify that monitoring can be terminated, the collected data must relate contaminant concentration to distance and contaminant concentration to time at a specific monitoring points. It must demonstrate that the contaminant plume is stable or subsiding, and will not expand further, and that contaminant levels in the ground and surface water are within accepted limits. When such

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Mathematical Models

There is a great variety of groundwater modelling software available and new software is continually being developed that is applicable to modelling Large Systems. Most of this software is proprietary and is listed in various commercial catalogues. Sources range from Government Agencies, Scientific Institutions to private consultants. In consideration of the foregoing, the selection of model software will be left to the proponent. However, because of the great variety of software available, the Director may ask that proponents submitting assessments that incorporate mathematical models provide data in a form that can be readily reviewed by the Ministry. The information that may be required includes the code, it's validation and the sensitivity testing and how the code limitations and assumptions affect the results. There are additional comments on the use of the mathematical model in Section 2.0 of Appendix A1.

APPENDIX C9

Guideline B-7 (formerly 15-08) Incorporation of The Resonable Use Concept

GUIDELINE B-7
(formerly 15-08)

INCORPORATION OF THE REASONABLE USE CONCEPT INTO MOEE GROUNDWATER MANAGEMENT ACTIVITIES

Legislative Authority:

The Ontario Water Resources Act

Responsible Director:

Director, Program Development Branch

Last Revision Date:

April, 1994

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SYNOPSIS

This guideline establishes the basis for determining the "reasonable use" of groundwater on property adjacent to sources of contaminants and for determining the levels of contaminant discharges considered acceptable by the Ministry.

The guideline is designed to facilitate implementation of the groundwater quality management directions contained in Procedure B-1-1: "Water Management -- Guidelines and Procedures of the Ministry of Environment and Energy," which are predicated on the protection of existing and potential reasonable uses of water. The reasonable use concept, in this context, applies only to groundwater quality management.

The technical details necessary for the application of the reasonable use approach shall be found in Procedure B-7-1: "Determination of Contaminant Limits and Attenuation Zones."

1.0 INTRODUCTION

The Ministry is charged with the conservation of the groundwater resources of the Province and the control of the use of these resources in an effective manner for the public good. To this end, the Ministry may wish to discourage the use of some environments for waste disposal and encourage the use of other environments. The Ministry position is that disposal sites should be placed in environments where their impact will be limited, that acceptable disposal methods should be used and that these methods should be compatible with those particular environments.

2.0 OBJECTIVES AND APPLICATION OF REASONABLE USE APPROACH

This document explains the role of a "reasonable use" approach in the Ministry's activities related to the protection of groundwater quality. It establishes procedures for determining what constitutes the reasonable use of groundwater on property adjacent to sources of contaminants and establishes limits on the discharge of contaminants from facilities, approved by the Ministry, that are used for the disposal of waste into the shallow subsurface (referred to as "disposal sites" or "disposal facilities" in this document).

The impact a disposal facility may have on the reasonable use of neighbouring properties shall be limited to an amount that would not justify an award for damages in a civil law suit.

This guideline facilitates implementation of the Ministry procedures document B-1-1, "Water Management -- Goals, Policies, Objectives and Implementation Procedures of the Ministry of Environment and Energy," which are designed to protect existing and potential uses of water.

This guidelines applies to matters which fall under the authority of the Environmental Protection Act or the Ontario Water Resources Act (subject to appeal). In cases where the Environmental Assessment Act or the Consolidated Hearings Act is utilized, the decision-making power lies outside the Ministry, and the Ministry can only make recommendations.

The reasonable use concept applies only to groundwater quality management. Ministry surface water quality management guidelines are presented in procedures document B-1-1.
This guideline does not apply to the restoration of groundwater supplies that have been contaminated by "unregulated" sources, such as closed landfills or spills. These situations are addressed by Guideline B-9 (formerly 15-10): "The Resolution of Groundwater Quality Interference Problems."

2.1 Definitions

The terms "disposal site," "contaminant attenuation zone," and "adjacent property" are defined in Procedure B-7-1: "Determination of Contaminant Levels and Attenuation Zones."

3.0 THE ADMINISTRATIVE BASIS FOR THE REASONABLE USE APPROACH

3.1 Guidelines

The Ministry position, as presented in the procedures document B-1-1, requires sufficient levels of environmental control to protect reasonable uses of the groundwater for present and future users in the Province.

This guideline is intended to assist in making decisions about current and future activities of the Ministry. It is not intended that all disposal facilities be investigated immediately to determine if they meet the levels for contaminant discharge described in this document.

3.2 Determination of Reasonable Use

The Ministry decision as to what constitutes reasonable uses of groundwater (either existing or potential) on land associated with, or adjacent to, disposal sites shall be made on a case-by-case basis. This is necessary because the wide variation in the quality, quantity and availability of groundwater makes a fixed approach impractical.

The responsibility for deciding what constitutes the reasonable use of the groundwater, as well as what uses should be protected, shall normally rest with the Regional Director. The Director's decision shall be made with input from a proponent and/or an assessment by staff. If this decision becomes a major issue, it may be made subject to a public hearing.

Reasonable current and potential uses shall be established, with respect to specific soil and water-bearing units in the subsurface, and would apply to all of the ground lying beneath a particular property.

The decision as to the reasonable use of the groundwater at a particular location shall be based on three major considerations:

3.2.1 The present use of groundwater in the vicinity

This is easily determined by a survey of the uses being made of the groundwater by nearby land owners and from data contained in Ministry files. In most instances, the current use shall be taken as the reasonable use.

3.2.2 The potential use of groundwater in the vicinity

Where there is no current use being made of the groundwater, criteria shall be established on the basis of the potential reasonable use(s) of that water, based on the existing quality and quantity of groundwater and the current use(s) of groundwater in the general area. In addition, planning agencies and others may provide input in determining potential land use (which might affect the use of the groundwaters).

3.2.3 The existing quality and quantity of the groundwater in the vicinity

The existing quality of the groundwater, and the amount that would be available to wells, shall be assessed by using data contained in Ministry files and a general knowledge of the hydrogeology in the area.

3.3 Potential for Domestic Consumption

The potential use of groundwater in Ontario will almost always be for domestic consumption. This is because:

(a) there are virtually no areas of Ontario where the quantity of groundwater that could be collected by a well would not meet the basic needs of a single family; and

(b) although there are parts of Ontario where the quality of the groundwater does not meet the Ontario Drinking Water Objectives, in most cases, individual owners have used such waters on a continuing basis over many years.

The presence of piped or surface water supplies does not, necessarily, mean that the groundwater is unsuitable for domestic consumption. However, such supplies may be a contributing factor in a determination where other considerations, such as groundwaters of poor quality and/or limited quantity, would detract from the usefulness of the groundwater.

The desirable qualities of drinking water are specified in the document "Ontario Drinking Water Objectives." Water quality objectives for the protection of fish and aquatic life and for agricultural use are stipulated in Tables 1 and 5 of the procedures document B-1-1. Each publication contains, in addition to the numerical objectives, directions as to their application.

It is also advisable to check with the Ministry for current Provincial Water Quality Objectives and Ontario Drinking Water Objectives.

In those instances where there is no Ministry objective for a given parameter, the Regional Director may specify what is considered to be an appropriate objective based on current scientific evidence.

3.4 Other Land Uses

Related land uses which could be affected by contaminants transported by groundwater, and which are compatible with a reasonable use approach, include:

(a) the use of the soil for agricultural activities;

(b) the use of the sub-surface for facilities such as sewers, electrical conduits or building foundations; or

(c) the use of the soil as fill.

4.0 THE TECHNICAL BASIS FOR THE REASONABLE USE APPROACH

A number of general technical considerations have been taken into account in the development of this document.

4.1 Good Groundwater Management Practices

The Ministry considers that the following positions shall represent good groundwater management practice:

(a) By selecting a suitable location and employing appropriate technology, no substantial groundwater resource in Ontario need be degraded by a waste disposal site or facility. However, there are subsurface units that contain groundwater that is unlikely to be used for water supplies. This may be because the groundwater in these units has naturally poor quality (e.g. brine), or the yield is too low for practical use, or the groundwater has been contaminated (by, for example, urban development) and this contamination is expected to continue. A beneficial and reasonable use of such a unit may be to receive and naturally attenuate or treat contaminants that have been generated as a result of the disposal of waste.

(b) Allocation of all of the attenuation capacity in a particular area to a single source of contaminants may not be prudent, because it may not be possible to prevent additional contaminant loadings in the future. Anticipated contaminant loadings shall be assessed, on a case-by-case basis.

(c) Provision shall be made for alleviating unacceptable environmental impacts, to the extent possible, should this prove to be necessary in the future. Unexpected events or failures shall be dealt with in a contingency plan. Those events that can reasonably be expected

to occur shall be dealt with as part of the site design.

4.2 Safety Margins

Using current technology, it is not generally possible to estimate accurately the quantity or the quality of contamination which will be discharged by a disposal facility. Uncertainty factors, on the order of at least five-fold, are common in the measurement of parameters such as hydraulic conductivity. Therefore, safety margins shall be considered in all estimates of contaminant discharge.

The appropriate safety margin would have to be calculated on a case-by-case basis and depend on the complexity of the hydrogeological environment, the characteristics of the waste treated and the contaminants produced, the value of the resource, and the consequences of failure.

A higher level of certainty is possible when an existing contaminant plume is present and can be used in an assessment.

4.3 Hydrogeological Aspects

There are some practical differences in the hydrogeological aspects of facilities used for the disposal of solid waste and those used for liquid waste. These differences, which can be considered in applying this guideline, are:

(a) As a contaminant plume will generally develop more rapidly from liquid than solid wastes, the monitoring data needed to measure the performance of a liquid waste disposal facility may be collected relatively quickly. The technical, administrative and financial concerns associated with long-term monitoring of a solid waste disposal facility are greater.

(b) Contingency measures for a liquid waste disposal facility include shutting off the waste discharge and providing pre-treatment for the effluent. Such relatively simple contingency measures are probably impractical for a solid waste disposal facility.

4.4 Adjacent Land Use

The use of land adjacent to a disposal facility, in addition to those uses associated with water supplies, can be affected by liquid or gaseous contaminants transported by the groundwater or moving through the unsaturated zone in the subsurface. The protection of these uses is also the responsibility of the Ministry. This is addressed in Guideline D-4 (formerly 07-07) "Land Use On or Near Landfills and Dumps."

5.0 ENVIRONMENTS UNSUITABLE FOR WASTE DISPOSAL

The Ministry may not support proposals for facilities for the disposal of waste in the following environments:

5.1 No appreciable attenuation can be provided

A disposal facility may not be supported in a location where no appreciable attenuation can be provided in the subsurface and an excessive amount of the attenuation required for acceptable discharge must be provided by dilution in surface waters. The impact on surface water by contaminants carried from a disposal site by the groundwater will almost always be undetectable.

However, unacceptable circumstances might exist where the subsurface travel time for contaminants is very short and the time for the degradation of the easily biodegradable organic contaminants is inadequate to substantially reduce their concentrations.

5.2 Natural attenuation capacity is weak

A disposal facility may not be supported in a location where the ability of the natural environment to attenuate contaminants is weak, as in fractured rocks, and as compensation, a very large area is required for the attenuation of contaminants. For technical reasons, environments where this is necessary are generally quite expensive to evaluate and contingency plans in such environments are seldom practical.

5.3 The subsurface is suited for better use

A disposal facility may not be supported in a location where the subsurface beneath the facility is particularly suited for a better use. For example, waste disposal may not be supported in an esker of sand and gravel where the esker might be needed at some future date for the development of a water supply.

5.4 The consequences of failure are unacceptable

A disposal facility may not be supported in a location where the consequences of failure are unacceptable. For example, waste disposal may not be supported where failure and a resulting contaminant discharge might affect the sole source of a community water supply to an unacceptable degree.

6.0 DETERMINATION OF CONTAMINANT LIMITS AND ATTENUATION ZONES

The technical details necessary for the application of the reasonable use approach to proposed disposal sites, operating disposal sites, and disposal sites requesting approval for expansion shall be found in Procedure B-7-1 "Determination of Contaminant Limits and Attenuation Zones." In this document, guidance is provided for:

(a) determining quantitatively the acceptable levels of various contaminants originating in disposal sites and impinging on adjacent properties; and

(b) assessing the suitability of a contaminant attenuation zone, and the limits of a disposal site.

APPENDIX C10

Procedure B-7-1 (formerly 15-08) Determination of Contaminant Limits and Attenuation Zones

PROCEDURE B-7-1
(formerly referenced by 15-08)

DETERMINATION OF CONTAMINANT LIMITS AND ATTENUATION ZONES

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7.0 THE DETERMINATION OF LIMITS FOR DISPOSAL SITES REQUESTINGAPPROVAL FOR EXPANSION

1.0 INTRODUCTION

In this document, the reasonable use concept is applied to: (a) determining quantitatively the acceptable levels of various contaminants originating in disposal sites and impinging on adjacent properties; and (b) assessing the suitability of a contaminant attenuation zone, and a disposal site. Terms are specifically defined in Section 3.0.

2.0 MINISTRY RESPONSIBILITY AND AUTHORITY

The Ministry is charged with the conservation of the groundwater resources of the Province and the control of the use of these resources in an effective manner for the public good. To this end, the Ministry may wish to discourage the use of some environments for waste disposal and encourage the use of other environments. The Ministry position is that disposal sites should be placed in environments where their impact will be limited, that acceptable disposal methods should be used and that these methods should be compatible with those particular environments.

For waste disposal activities the Ministry has the management authority to:

(a) Issue a Certificate of Approval which would permit the use of property forcontaminant attenuation or treatment. Discharge to neighbouring property must have no more than a negligible or trivial effect on the existing and potential reasonable use of this property. This is accomplished by limiting any increases in contaminant levels caused by this discharge to those specified in Section 5.1. The question of whether the effect is negligible, if challenged, could be established by the courts, which would decide if there is damage and how it can be measured in terms of dollars. This is inherent in the approach used by the Ministry in other situations, such as the issuance of air approvals.

(b) Prevent the owner of a disposal site, or a proposed disposal site, from using the sub-surface beneath the site for waste disposal purposes if this use is not felt to be in the public interest.

This management authority is subject to the limitations and qualifications in in Guideline B-7, "Incorporation of the Reasonable Use Concept into MOEE Groundwater Management Activities."

3.0 DEFINITION OF TERMS

For the purpose of this document, the Ministry will consider three areas in assessing waste disposal proposals: the disposal site, the contaminant attenuation zone, and the adjacent property. These are defined in the following Sections.

3.1 The Disposal Site:

For the purposes of this document the term "disposal site" includes, but is not limited to the following:

(a) a "waste disposal site" under Part VI of the Environmental Protection Act (EP Act) and a "landfilling site" as defined in O. Regulation 309;

(b) an "exfiltration lagoon" defined as a "sewage works" under the Ontario Water Resources Act (OWRA); and,

(c) a "large subsurface sewage disposal system" under Part VIII of the EP Act and as defined in Notice 3/87, July 15 1987.

The intention is to identify the areas that receive waste and the adjoining land that is necessary for proper site operation. For example, in the case of a landfill, the disposal site or waste disposal site comprises the area on or in which wastes are deposited, (the "fill area"), and any bordering land, (the "peripheral area"), as shown on the accompanying diagram. In the case of an "exfiltration lagoon" or a "large subsurface sewage disposal system," terminology is defined in the appropriate guidelines.

The following comments apply to a disposal site:

(a) Future use of the land should be strictly controlled. Based on technical considerations, such control should be permanent or continued until it can be shown that such control is no longer necessary (see Section 46, EP Act).

(b) As there are environments which the Ministry does not believe are appropriate for waste disposal, the Ministry will either oppose the use of such environments or will insist that stringent safeguards be incorporated in any design for the disposal site and that there be appropriate monitoring and contingency plans. These safeguards may include provision for the collection and treatment of any contaminants which will be produced. Guidelines for identifying environments unsuitable for waste disposal are presented in Section 5.0 of Guideline B-7.

3.2 The Contaminant Attenuation Zone

The purpose of a "contaminant attenuation zone" is to allow the limited impairment of use of off-site property by means of easements or other methods without imposing the severe restrictions on land use which apply to the disposal site.

Where appropriate, a contaminant attenuation zone may be supported. It is outside of the disposal site and it is defined both with respect to the area of land which it underlies and also with respect to the depth at which it lies.

In the contaminant attenuation zone, it is intended that contaminants will be naturally attenuated to levels compatible with the reasonable use of the adjacent property as discussed in Guideline B-7, Section 3.2 and in order to meet the criteria specified in Section 5.1, below, contaminant levels in the contaminant attenuation zone may impair some uses of that zone. The operator of the disposal site must obtain the right to the use of this zone by reaching agreement with the property owner. The agreement should be registered on the title to this land.

Circumstances and environments favouring the designation of a contaminant attenuation zone are discussed in Section 4.0.

3.3 The Adjacent Property

The "adjacent property" is the land bordering the disposal site or the contaminant attenuation zone. Discharge of contaminants to adjacent property will have no more than a negligible effect on the present or potential reasonable use of that property. This will ensure that:

(a) the presence of the contaminant will not interfere with the construction, installation or good operation of any usual facility in the subsurface, such as utility conduits;

(b) the soil will not be contaminated to a degree which would interfere with its use;

(c) the groundwater will not be contaminated to a degree which would impair its reasonable use, as addressed in Guideline B-7 (Section 3.2).

4.0 CIRCUMSTANCES AND ENVIRONMENTS SUITABLE FOR A CONTAMINANT ATTENUATION ZONE

The Ministry may support an application for a disposal site involving the acquisition of land or an easement for a contaminant attenuation zone only under the following circumstances:

4.1 Alternate Sources of Water Available

An application may be supported where an alternate source of water is far superior to any associated with a contaminant attenuation zone. Here the Ministry may support the use of the groundwater for dilution and attenuation in a contaminant attenuation zone and take the position that the effect on reasonable uses on adjacent property would be negligible or insignificant, because that groundwater would not need to be used in any case.

This circumstance could arise as follows:

(a) where two water-bearing units are present, one being far superior to the other with respect to the quality, quantity and the accessibility of the water contained in it, the Ministry may accept the inferior unit as a contaminant attenuation zone, provided that this will not interfere with the use of the superior unit; or

(b) where good supplies of water are available, either from surface water sources or from municipal systems, and the groundwater supplies in a particular unit are marginal with respect to their quality and/or their quantity, the Ministry may support the use of that groundwater as a contaminant attenuation zone.

4.2 Contaminant Zone Limited

An application may be supported where only an acceptably small, clearly defined and hydrogeologically restricted portion of a subsurface unit will be degraded and this subsurface unit is not likely to be required for a higher use.

This procedure would allow the Ministry to support the use of certain Crown Lands in Northern Ontario or well defined zones of groundwater flow such as may be present in flood plains, as contaminant attenuation zones despite their physical ability to yield groundwater in "useful" quantities.

4.3 High Levels of Dissolved Solids Present

An application may be supported, under special circumstances and on a case-by-case basis, where naturally high levels of iron, manganese and/or total dissolved solids (where these are associated with hardness) are present in the groundwater and as a result, the limits imposed in Section 5.1 can not be met (see situations described in Section 5.2, examples 2 and 3). It is necessary to assess on a case-by-case basis because:

(a) unlike the case in surface waters, concentrations of iron, manganese and total dissolved solids commonly in excess of the Ontario Drinking Water Objectives are naturally present in Ontario groundwaters, and these groundwaters are routinely used for domestic supplies;

(b) these parameters are not related to health, at the levels stated in the Ontario Drinking Water Objectives, and in addition can be removed from a water supply with commonly available techniques; and

(c) it is not practical to eliminate waste disposal in a large percentage of the Province where the presence of iron, manganese and total dissolved solids naturally occurs in excess of the Ontario Drinking Water Objectives.

4.4 Areas Suitable in the Judgment of the Regional Director

An application may be supported where, in the judgment of the Regional Director, the most appropriate use of that environment would be as a contaminant attenuation zone, although it is suitable for other purposes as well.

5.0 THE DETERMINATION OF LIMITS FOR PROPOSED DISPOSAL SITES

5.1 Basic Approach

In accordance with the appropriate criteria for particular reasonable uses, such as those specified in the Guideline B-1:

"Water Management -- Guidelines and Procedures of the Ministry of Environment and Energy", a change in quality of the groundwaters on the adjacent property will be acceptable only as follows:

"Quality cannot be degraded by an amount in excess of 50% of the difference between background and the quality criteria for any designated reasonable use except in the case of drinking water. In the case of drinking water, the quality must not be degraded by an amount in excess of 50% of the difference between background and the Ontario Drinking Water Objectives for non-health related parameters and in excess of 25% of the difference between background and the Ontario Drinking Water Objectives for health-related parameters. Background is considered to be the quality of the groundwater prior to any man-made contamination."

This approach imposes a permanent upper limit to the amount of contamination that the owner of the adjacent property should have to tolerate. In accordance with Section 2.0, it is the Ministry's judgment that such increases in contaminant levels will have no more than a negligible or trivial effect on the existing or potential reasonable use of the adjacent property.

In assessing the amount of degradation that is acceptable, consideration is given to the natural, uncontaminated quality of the groundwater, the present quality of the groundwater and potential contamination of the groundwater from all sources.

5.2 Examples of the Application of the Concept

Examples of the application of this concept to three different situations are provided below:

> Example 1 -- Where the designated reasonable use of groundwater allows no change in quality, no change is acceptable.
>
> Example 2 -- Where the designated reasonable use of the groundwater is drinking water and the groundwater quality is presently better than the Ontario Drinking Water Objectives, a lowering of water quality on the adjacent property will be acceptable in accordance with the formula stated above.

Example 3 -- Where one or more groundwater quality parameters are currently at concentrations greater than the limits specified in the Ontario Drinking Water Objectives, but the groundwater is nonetheless in use as a drinking water source, then no further increase in the levels of these water quality parameters will be acceptable (see Section 4.3 for possible exception). Under these circumstances, increases in other parameters may be allowed in accordance with Section 5.1.

5.3 Examples of the Calculations

Two calculations are required to determine the amount of contamination that can discharge from a disposal site onto the adjacent property. The first calculation addresses the total contaminant impact at that location from all sources of contamination. The second addresses the permissible impact from the particular disposal site.

The maximum concentration (Cm) of a particular contaminant that would be acceptable in the groundwater beneath the adjacent property is calculated in accordance with the following relationship:

$$Cm = Cb + x(Cr-Cb)$$

The terms are defined as follows:

Cb This is the background concentration of the particular contaminant in the groundwater before it has been affected by human activity (Section 5.1). This allows consideration to be given to the amount of increase in contaminant level.

Cr This is the maximum concentration of the particular contaminant that should, in accordance with the Province's water management guideline be present in the groundwater. This value is dependent on the use (reasonable use) to be made of that groundwater (see Guideline B-7). It allows consideration of the total amount of contamination.

x This is a constant that reduces the contamination to a level that is considered by the Ministry to have only a negligible effect on the use of the water. For drinking water x is 0.5 for non-health related parameters or 0.25 for health related parameters. For other reasonable uses it is 0.5 (Section 5.1).

Levels of contamination greater than Cm may have an appreciable effect on the use of the adjacent property and the Ministry will not support an application for a disposal site with contaminant discharges which would cause this level to be exceeded.

The maximum concentration of a particular contaminant (Cw) originating in the disposal site that can be permitted to reach the adjacent property and still not cause Cm to be exceeded can be calculated in accordance with the following relationship:

$$Cw = Cm - Cp - Co$$

The terms are defined as follows:

Cp This is the concentration of the particular contaminant in the groundwater at the time of assessment, (i.e. the present background). This water may already contain some contaminants (Section 5.1). These contaminant levels must be subtracted to determine the contaminant increment that can be permitted from the disposal site.

Co This is the potential contaminant increase from other sources with a high degree of probability (see Guideline B-7, Section 4.1(b)). For example, potential chloride contamination from a highway under construction next to the site must be subtracted to determine Cw.

Using chloride from a landfill as an example, the maximum allowed chloride level (Cm) in the groundwater beneath the adjacent property and the maximum chloride discharge (Cw) to the adjacent property from a hypothetical landfill are calculated as follows:

(a) The reasonable use of the groundwater beneath the adjacent property has been determined to be for domestic supplies.

(b) The Ontario Drinking Water Objective for chloride is 250 mg/L. This represents Cr.

(c) The natural uncontaminated background concentration of chloride is estimated to have been 10 mg/L. This represents Cb.

(d) The measured concentration of chloride at the time of the assessment is 40 mg/L. This represents Cp.

(e) The expected additional chloride increase from a nearby highway that is presently under construction is estimated to be 20 mg/L. This represents Co.

(f) Chloride is considered to be a non-health-related parameter and therefore the constant (x) is 0.5.

The maximum allowed concentration (Cm) of chloride beneath the adjacent property, in accordance with the relationship:

$Cm = Cb + x\ (Cr-Cb)$ is therefore:

$10 + 0.5\ (250-10) = 130$ mg/L

The maximum concentration of chloride (Cw) from the disposal site that can be permitted to reach the adjacent property, in accordance with the relationship $Cw = Cm - Cp - Co$ is therefore:

$130 - 40 - 20 = 70$ mg/L

It should be noted that the chloride ion may not be the critical contaminant (i.e. the contaminant parameter which will most closely approach its maximum allowed value, Cm, and thus represent the limit to which the site is designed). However, it is commonly used in contaminant investigations because of its usefulness as a "tracer". The critical contaminant is dependent on several factors including the characteristics of the wastes and the hydrogeologic environment and is determined on a case-by-case basis.

5.4 Site Assessment

The assessment of the proposed disposal site should be carried out in accordance with any pertinent Ministry guidelines. In addition, Section 4.0, "The Technical Basis for the Reasonable Use Approach," of Guideline B-7 should be considered with particular reference to those parts relating to the provision of a safety margin in making estimates of contaminant discharges (Section 4.2).

6.0 LIMITS FOR OPERATING DISPOSAL SITES

An operating disposal site is handled as follows:

(a) An operating site should meet the same limits for contaminant discharge (Section 5.1) as a proposed site.

(b) The judgement as to the amount of off-site impact that the site will produce may be based on actual off-site measurements of contaminant levels or on predictions of off-site contaminant levels which are based on on-site measurements. This reduces the requirements for a safety margin in calculations (Guideline B-7, Section 4.2).

(c) If contaminant concentrations exceed the limits specified in Section 5.1, the site should be closed in a manner to minimize environmental damage, or the operation should be modified. It is acceptable to modify the operation of the disposal site, for example in the case of a landfill by collecting a part of the leachate, in order to meet the specified limits. However, if these levels are exceeded, all waste disposal, except that done in conjunction with a reasonable plan for closure or with remedial activities, should be terminated until the specified limits have been met, or until monitoring data indicate that these limits will be met. Determinations on the replacement of contaminated water supplies and the

abatement of the contaminant plume must be made on a case-by-case basis in accordance with Guideline B-9 (formerly 15-10) entitled: "Resolution of Groundwater Quality Interference Problems."

7.0 LIMITS FOR DISPOSAL SITES REQUESTING APPROVAL FOR EXPANSION

An Approval for a disposal site requesting expansion will be handled in the same manner as an Approval for a new site or a proposed site (i.e. it must meet the limits specified for contaminant discharge in Section 5.1).

APPENDIX C1

Guideline B-1-1 Water Management

PROCEDURE B-1-1
PIBS# 3303

WATER MANAGEMENT

POLICIES

GUIDELINES

PROVINCIAL WATER QUALITY OBJECTIVES

OF THE

MINISTRY OF ENVIRONMENT AND ENERGY

JULY, 1994

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1.0 INTRODUCTION

1.1 Preamble

This 1994 publication contains the Ministry of Environment and Energy policies and guidelines for the management of the province's water resources. It gives direction on how to manage the quality and quantity of both surface and ground waters.

With respect to surface water quality the goal is to ensure that the water quality is satisfactory for aquatic life and recreation and that water uses which require more stringent water quality be protected on a site specific basis. The Provincial Water Quality Objectives (PWQO's) will protect aquatic life and recreation uses and policy direction is provided about how to deal with situations where water quality is better or worse than the Objectives.

Ground water quality is to be preserved to protect the greatest number of uses.

Surface and ground-water quantity is to be managed to ensure a fair sharing, conservation, and sustainability of the resource.

1.2 Background

In 1970, the Ontario Water Resources Commission (OWRC) published "Guidelines and Criteria for Water Quality Management in Ontario". It was based on the 1967 publication by the OWRC entitled "Policy Guidelines for Water Quality Control in the Province of Ontario" and introduced water quality criteria for various uses. The 1970 publication concerned itself almost exclusively with surface water quality management.

In 1978, the Ministry of the Environment substantially revised and expanded the 1970 OWRC publication to include a range of policies and implementation procedures for surface and ground water quality and quantity management. The 1978 publication was modified in 1984 by incorporating changes to the Provincial Water Quality Objectives, but the goals, policies and implementation procedures for water management remained unchanged. This 1994 publication updates the 1984 publication but maintains the original policy directions. It provides a framework for a number of detailed guidance documents which assist in the implementation of the various policies.

This publication does not contain detailed procedures on how to achieve the protection of the water resources as defined by the policies and guidelines. Instead, it provides the basis upon which the limits of the uses of the resources can be established. For example, pollutant discharge limits can be determined based on the policies for water quality and the existing physical, chemical and biological conditions of the receiving water. How these limits may be achieved is a matter of local choice or conditions and other pollutant management strategies. Implementation

details are contained in numerous supporting referenced documents throughout the publication.

1.3 MOEE's Legislative Authority

The Ministry of Environment and Energy's legislative authority to manage water comes primarily from two acts, the Ontario Water Resources Act (OWRA) and the Environmental Protection Act (EPA). The OWRA, which gives the MOEE extensive powers to regulate water supply, sewage disposal and to control sources of water pollution, expressly states that for the purpose of the Act the Minister has the supervision of all surface and ground waters in Ontario. The EPA prohibits the discharge of contaminants to the natural environment, including water except where specifically permitted by a Certificate of Approval. The goals, policies, and guidelines set out in this document assist those making decisions under or related to these Acts. They give, for example, directions that assist in defining site-specific effluent limits, which then may be incorporated into Certificates of Approval or Control Orders. These control documents are issued under the authority of the legislation, and thus become legally binding and constitute the basis for compliance and enforcement actions. The policies and guidelines themselves do not have any formal legal status but, by their successful use over the years, are now seen as standard practices for water resources management.

There are many other important aspects of water management that do not fall under the jurisdiction of the MOEE, but are the responsibility of other provincial and federal jurisdictions, most notably the Ontario Ministries of Natural Resources, Health and Agriculture, Food and Rural Affairs, Conservation Authorities and the Federal Departments of Fisheries and Oceans and Environment Canada.

1.4 The Policies and Guidelines of Water Management

General

The policies and guidelines in this publication are based on important principles such as the protection, preservation, and sustainability of the province's water resources for future generations. In order to effectively implement these principles, ecosystem and watershed management, how pollutants are controlled, and the inter-relationship of air, water and land management are all important considerations.

Ecosystem Management

The ecosystem approach views the ecosystem as composed of air, water, land and living organisms, and the interactions among them. It is the basis for environmental protection and resource management. It requires consideration of the cumulative effects on the environment, the inter-dependence of air, water and living organisms, and the relationships among the environment, the economy and society. Within the context of water resource management, ecosystem management includes the physical, chemical and biological components and their

inter-relationships.

Environmental Protection and Multi-Media Considerations The water management policies and guidelines supporting Provincial Water Quality Objectives (PWQO's) are the basis for establishing acceptable limits for water quality and quantity, consistent with the protection of the aquatic ecosystem and ground-water. They are equally applicable to local site specific situations, an entire watershed, or the Great Lakes. They establish the limit or the extent to which a water resource can be used without interfering with other uses.

In setting the limits or requirements for the protection of the water resource, the protection of other media such as land and air must be considered and are taken into account in the Approvals and Environmental Assessment processes. A project may have to be altered or scaled down to achieve the appropriate protection of all media. Multi-media considerations may lead to more stringent limits compared to those needed to protect the water resource alone.

MOEE's environmental protection strategy places priority on preventing, then minimizing the creation of pollutants. When the creation of pollutants cannot be avoided, the Ministry's priority is to prevent their release to the environment and second, to minimize their release.

a) Pollution Prevention

A guiding principle for the management of pollutants is that the pollution prevention approach is far more desirable than end of pipe treatment. Pollution prevention includes practices that eliminate or reduce through conservation or more efficient use of hazardous or non-hazardous materials, energy, water, or other resources. Finding alternative production processes and chemicals, using best management practices and water conservation are preferable approaches to simply concentrating on meeting the established effluents limits through waste treatment.

b) Management of Hazardous Substances

Hazardous substances (i.e. persistent, bioaccumulative toxic substances), should be dealt with regard to their impact on the ecosystem. These hazardous properties make control on an ecosystem and multi-media (air, water, land) basis absolutely essential. The hierarchial management approach of reducing discharges to zero through banning or phasing out, or at the very least, curtailing escape to the environment as much as possible, is one of the fundamental approaches for the control of these pollutants in Ontario.

c) Municipal and Industrial Strategy for Abatement (MISA)

The limits regulations developed through the MISA program have as their goal the virtual elimination of persistent toxic substances. The effluent limits contained in these regulations generally are based on levels achievable by best available treatment technology economically achievable. These regulations represent a major and important

component in the Ministry's strategy to abate pollution sources and improve the ecosystem.

Watershed Planning

Watershed planning considerations address the inter-relationships of the hydrologic regime, water use patterns and land use planning thus making watershed planning a preferred basis for water management decisions. In keeping with the ecosystem approach to water resource management, the inter-relationship of surface and ground water quality and quantity have to be recognized in water management decision making processes. For example, decisions related to Permits To Take Water should be reviewed for their potential cumulative impact on water quality.

Any activity that has the potential for affecting water quality or quantity requires close scrutiny. For example, the development of land and the resulting non-point sources of pollution have proven to have significant impact on water resources, and thus deserve careful attention. The inter-relationships of land use management and water management have to be clearly understood and considered if the principles of protection, preservation and sustainability are to be preserved.

2.0 PROVINCIAL WATER QUALITY OBJECTIVES

Provincial Water Quality Objectives (PWQO) are numerical and narrative criteria which serve as chemical and physical indicators representing a satisfactory level for surface waters (i.e. lakes and rivers) and, where it discharges to the surface, the ground water of the Province. The PWQO are set at a level of water quality which is protective of all forms of aquatic life and all aspects of the aquatic life cycles during indefinite exposure to the water. The Objectives for protection of recreational water uses are based on public health and aesthetic considerations.

Provincial Water Quality Objectives are intended to provide guidance in making water quality management decisions such as the designation of the surface waters of the Province which should not be further degraded. They are often used as the starting point in deriving waste effluent requirements included in Certificates of Approval and other instruments issued to regulate effluent discharges. They are used to assess ambient water quality conditions, infer use impairments, assist in assessing spills and monitoring the effectiveness of remedial actions.

The Ontario Ministry of Environment and Energy has established a comprehensive process for setting Provincial Water Quality Objectives as described in the MOEE publication "Ontario's Water Quality Objective Development Process", 1992. Reference documents providing details on the development of each PWQO are also available from MOEE.

A complete listing of the PWQO is contained in Appendix A. The PWQO listing is routinely updated to reflect new or revised Objectives.

In addition to the Provincial Water Quality Objectives, water resource managers can employ,

where appropriate, a variety of other Objectives or Guidelines that relate to specific uses. The Ontario Drinking Water Objectives, published by MOEE, contains a comprehensive list of treated drinking water objectives primarily employed for the protection of public health. The Canadian Water Quality Guidelines, published for the Canadian Council of the Ministers of the Environment, contain a wide range of specific-use objectives including agricultural uses and industrial water supplies.

3.0 SURFACE WATER QUALITY MANAGEMENT

3.1 Goal

The surface waters of Ontario are put to many uses, and each use has specific water quality requirements. As a general management principle, water quality must be protected, preserved or restored to permit the greatest number of uses, based on the best interest of the people of Ontario. Water which meets the water quality requirements for the protection of aquatic life and recreation (i.e. the Provincial Water Quality Objectives) will, in most cases, be suitable for other surface water uses.

The surface water quality management goal is, therefore:

> TO ENSURE THAT THE SURFACE WATERS OF THE PROVINCE ARE OF A QUALITY WHICH IS SATISFACTORY FOR AQUATIC LIFE AND RECREATION.

Provincial Water Quality Objectives are useful indicators of, but not direct measurements of aquatic ecosystem health. Non-chemical factors such as the loss of habitat, sedimentation, water quantity regulation and the introduction of non-indigenous species often have profound and over-riding influences on aquatic ecosystems.

Meeting the Provincial Water quality Objectives is the minimum requirement. Considerations such as ecosystem health, the additive effects of more than one chemical, or the protection of other uses may lead to more stringent requirements. For example, in site specific situations, where better water quality is required than that provided by the PWQO's to protect beneficial uses in a given location, the appropriate, more stringent criteria shall be applied in that location.

Ontario borders on inter-provincial and international waters, and the implications of the Province's activities must be considered in that context. For example, the Province has agreed that the Specific Water Quality Objectives contained in the Great Lakes Water Quality Agreement or more stringent Provincial objectives shall be used in environmental programs to achieve and maintain Great Lakes water quality. Also, Ontario enforces effluent requirements developed by the Federal Government for specific industrial sectors and for specific pollutants.

3.2 Policies

The following policies deal with two situations: a) where water qualify is better than the Provincial Water Quality Objectives; b) where water quality presently does not meet the Objectives. These water quality designations are made on a parameter by parameter basis and compliance or non-compliance with the Provincial Water Quality Objectives should be determined from data that adequately reflect the spatial and temporal variations of the quality of the waterbody under consideration.

3.2.1 Areas with Water Quality Better than the Objectives

Policy 1

"In areas which have water quality better than the Provincial Water Quality Objectives, water quality shall be maintained at or above the Objectives." Although some lowering of water quality is permissible in these areas, degradation below the Provincial Water Quality Objectives will not be allowed, ensuring continuing protection of aquatic communities and recreational uses.

3.2.2 Areas with Water Quality Not Meeting the Objectives

Policy 2

"Water quality which presently does not meet the Provincial Water Quality Objectives shall not be degraded further and all practical measures shall be taken to upgrade the water quality to the Objectives."

Evaluations of existing conditions in problem areas shall be conducted and all reasonable and practical measures shall be taken to upgrade water quality to the Provincial Water Quality Objectives. Where new or expanded discharges are proposed, no further degradation will be permitted and all practical measures shall be undertaken to upgrade water quality. However, it is recognized that, in some circumstances, it may not be technically feasible, physically possible or socially desirable to improve water quality toward the Provincial Water Quality Objectives.

Accordingly, where it is clearly demonstrated that all reasonable and practical measures to attain the Provincial Water Quality Objectives have been undertaken but where:

1) the Provincial Water Quality Objectives are not attainable because of natural background water quality; or

2) the Provincial Water Quality Objectives are not attainable because of irreversible human-induced conditions; or

3) to attain or maintain the Provincial Water Quality Objectives would result in substantial and widespread adverse economic and social impact; or

4) suitable pollution prevention techniques are not available; then deviations from this policy may be allowed, subject to the approval of the Ministry of Environment and Energy. Detailed procedures for preparing a deviation are described in "Guideline for Handling Requests for Deviations." in the MOEE document entitled Deriving Receiving Water Based, Point-source Effluent Requirements for Ontario Waters (1994).

Before approval for a deviation is granted, consideration should be given to the impact of the deviation on the mandate or concerns of other agencies and the public. Agencies such as the Ministries of Natural Resources, Health, Agriculture, Food and Rural Affairs, Conservation Authorities and the Federal Departments of Environment and Fisheries and Oceans should be consulted, where appropriate.

Where public hearings into proposals for new or expanded discharges are held under the Environmental Assessment Act or the Ontario Water Resources Act, such hearings may be utilized to consider this issue.

As a condition to granting a deviation, a periodic review should be required of the reasons leading to the deviation and an evaluation of their continued relevance.

3.3 Hazardous Substances

Hazardous substances, acting individually or in combination with other substances, can cause death, disease including cancer, behaviour abnormalities, genetic mutations, physiological malfunctions, malfunctions in reproduction or physical deformities in organisms (plants and animals, including humans) or their offspring. The consequences of contamination of the environment by hazardous substances may also include a loss of valuable species, restrictions on important socio-economic activities or a variety of irreversible ecological changes that threaten future use and enjoyment of the environment. Hazardous substances can occur in nature (e.g. mercury) or can be created by human activity (e.g. PCB). Some have been developed to meet important needs (e.g. DDT) and some are unintentional by-products of industrial activities (e.g. dioxins).

Some hazardous substances listed in Appendix B, have been banned from use in Ontario. Other candidate substances for bans, phase-outs or reductions are included in Tables 1.7 and 1.8 in the MOEE publication entitled "Candidate Substances For Bans, Phase-Outs Or Reductions - MultiMedia Revision" October 1993.

Because of their inherently hazardous nature, every effort should be made to prevent these substances from gaining access to the environment. From an environmental protection perspective, the application of pollution prevention principles, that is, avoiding the creation of the pollutants in the first place, is far more desirable than reliance on waste treatment.

The MOEE policies for the management of hazardous substances in surface waters are:

Policy 3

"Prevent the release, in any concentration, of hazardous substances that have been banned".

Provincial Water Quality Objectives have been developed for many of the banned hazardous substances in Appendix B. It should be emphasized that these Objectives are not to be used for the development of new waste loadings for these substances. Rather, they provide a benchmark available to assess the environmental implications of past releases or accidental losses and remediation work.

Specific control procedures for the other hazardous substances as for example those contained in the "Candidate Substances For Bans, Phase-Outs Or Reductions" report have yet to be formulated pending further technical and socio/economic evaluations. The MOEE policy for dealing with these substances is:

Policy 4

"Ensure that special measures are taken on a case by case basis to minimize the release of hazardous substances that have not been banned."

For these hazardous substances it is not appropriate to use the assimilative capacity of receiving waters and mixing zones to attenuate the treated wastes.

3.4 Mixing Zones

A mixing zone is defined as an area of water contiguous to a point source or definable diffuse source where the water quality does not comply with one or more of the Provincial Water Quality Objectives. A mixing zone is, under no circumstances, to be used as an alternative to reasonable and practical treatment. It must be designed to be as small as possible and is one factor in establishing effluent requirements.

The concept of mixing zones recognizes that the cost of treating all waste discharges to the PWQO's may not be justified. As a general principle, the dilution of such effluents, and thus the use of mixing zones, should be minimized and limited to conventional pollutants.

Policy 5

"Mixing zones should be as small as possible and not interfere with beneficial uses. Mixing zones are not to be used as an alternative to reasonable and practical treatment."

Conditions within a mixing zone must not result in toxic conditions or irreparable environmental damage including risk to ecosystem integrity and human health nor interfere with water supply, recreational or other water uses.

Terms and conditions related to a mixing zone will be designated on a case-by-case basis and may be specified in Certificates of Approval, Control Orders, Requirements and Directions, or approvals to proceed under the Environmental Assessment Act. Mixing zones do not apply to discharges that have not received MOEE approval (eg. spills and illegal discharges).

A detailed description of mixing zone requirements and implementation procedures are contained in Deriving Receiving-Water Based, Point Source Effluent Requirements for Ontario Waters, MOEE, 1994.

3.5 Implementation Procedures for Effluent Requirements

Substances that impair water and sediment quality are a major environmental problem. Many of these substances are toxic to aquatic life such as fish and aquatic invertebrates, in both the water column and sediment. Others are persistent and bioaccumulative and can cause food chain effects resulting in elevated levels of contaminants in fish, wildlife, birds and people who eat fish. Substances, such as nutrients, when present in excess can upset the natural balance of an ecosystem. Still others can impair the use of the water by producing tastes and odours.

Polluting substances enter the water from many sources. Industrial and municipal discharges of wastewater, contaminated runoff from urbanized and agricultural areas, deposition of air pollutants, and lakefilling all are important sources of contaminants. Some substances, such as metals, are naturally occurring and their presence in water can be the result of natural processes.

The following are general procedures for determining effluent requirements. In general terms the directions given deal with how to define limits for wastewater discharges to surface water using the two policies for surface water quality management described in Section 3.2 as well as the policies dealing with hazardous substances, and mixing zones which are presented in sections 3.3 and 3.4, respectively. Detailed directions for setting effluent requirements are contained in the MOEE publication, "Deriving Receiving -Water Based, Point-Source Effluent Requirements For Ontario Waters", 1994.

Guidelines and procedures related to the management of aquatic sediments (MOEE Policy B-1-3) and lakefilling (Policy B-1-4) are fully described in MOEE publications "Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario, 1993" and "Fill Quality Guidelines for Lakefilling in Ontario, 1992", respectively.

3.5.1 General Procedures for Establishing Effluent Requirements

In establishing effluent requirements for discharges to surface waters, the procedures outlined below should be followed:

1) Site-specific receiving water assessments will be conducted to assess existing conditions and determine effluent requirements based on the waste assimilative capacity of the receiver.

2) The site-specific effluent requirement, so derived, will be compared, where applicable, to appropriate federal or provincial regulations or guidelines for effluent discharges and the most stringent requirement will be applied.

3) The effluent requirement derived from the above procedures, expressed as waste loadings and/or concentrations, will be incorporated into a Certificate of Approval or other control document.

4) For existing discharges in areas where water quality is degraded and does not meet the Provincial Water Quality Objectives, the Ministry may develop a pollution control program with each discharger to meet the effluent requirement determined from the above procedures.

Through the incorporation of water quality based limits into legally enforceable control documents such as a Certificate of Approval, the policies for water quality management become enforceable. These limits most commonly are for municipal or industrial point sources, but may also be applied to cooling water, stormwater or other polluting sources.

4.0 GROUND WATER QUALITY MANAGEMENT

Ground water in Ontario is an important source of water for various uses, including domestic, public, agricultural, commercial and industrial water supplies. Ground water is often the primary source of rural and urban drinking water supplies. It is an important component of the aquatic ecosystem. Streamflow originates and is maintained in many parts of the province through sources from ground water. Ground water maintains wetland ecosystems.

For practical proposes, and with present control technology, ground water contamination, in most cases, can be considered long term once it occurs. In general, restoration of ground water quality is difficult and extremely expensive. Therefore, the emphasis of ground water management is on pollution prevention. Ontario's ground water quality management principle and implementation procedures reflect the fact that ground water differs from surface water in significant respects.

In the majority of cases, consumption by humans will be the most important use of water to be protected, but there are other ground water uses such as agriculture with specific water quality

requirements which also will be protected. The protection of aquatic life is a very important consideration in cases where ground water is a component of streamflow.

Recognizing that ground water is a valuable resource supporting a variety of uses, the Ministry of Environment and Energy's policy for ground water quality management is:

Policy 6

"To protect the quality of ground water for the greatest number of beneficial uses."

4.1 Implementation Procedures

4.1.1 Regulated Sources of Pollution

Activities with the potential to adversely affect ground water that require MOEE approval under the OWRA or EPA are wide-ranging and include water works, wastewater treatment infiltration basins, landfills, waste disposal into deep wells, spray irrigation, sludge utilization or disposal operations, septic tank systems and mine tailings.

The treatment or elimination of pollutants from existing regulated sources is required where the polluter fails to demonstrate that such measures are impractical and unnecessary to remediate use impairment, prevent further degradation and improve water quality. Where such measures are not practicable, the Ministry may require replacement of the affected supplies.

The waste control requirements for proposed regulated sources of pollution are established on a case by case basis. Water quality degradation is controlled to protect existing and potential reasonable uses of both ground and surface waters. The MOEE may stipulate requirements for these activities related to the quality and quantity of the discharge in a Certificate of Approval.

MOEE Policy B-7, "Incorporation of the Reasonable Use Concept into the MOEE Ground water Management Activities", contained in the MOEE Manual of Guidelines and Procedures, 1994, addresses active or proposed sources of contaminant discharges to ground water that are being permitted or regulated by the Ministry. This includes landfills, exfiltration lagoons and large subsurface disposal systems. Policy B-7 provides a procedure for determining the reasonable use of ground water and establishes limits to the amount of degradation that will be allowed such that this use will not be impaired.

4.1.2 Unregulated Sources of Contamination

There are a number of activities that do not require specific approval under the Ontario Water Resources Act or the Environmental protection Act but have the potential to contribute to ground water contamination. They include non-point source activities (i.e. crop fertilization, manure application, road deicing), salt storage areas, unlicensed and closed landfills, leaks, spills and decommissioning clean-up.

The treatment or elimination of pollution from unregulated sources will be required where it is demonstrated that such measures are practicable and necessary to correct use impairment and will prevent further degradation or improve water quality. Where such measures are not practical, the Ministry may require replacement of the affected supplies.

MOEE Policy B-9, "Guidelines for the Resolution of Ground water Quality Interference Problems", contained in the MOEE Manual of Guidelines and Procedures, 1994, addresses the cleanup or remediation of contaminant discharges to the ground water that have not been subject to approval by the Ministry. This includes such things as spills and closed waste disposal facilities. Policy B-9 establishes the urgency of the Ministry response, an approach based on cost/benefit analysis for determining the extent or degree of cleanup and establishes the Ministry position with respect to the restoration of water supplies that have been contaminated.

5.0 WATER QUANTITY MANAGEMENT

The protection and control of water quantity is a key component of Ontario's water management strategy. Management of water quantity is needed to avoid conflicts among various users. Water quantity and quality are closely related, inasmuch as the amount and physical characteristics of water available are an important aspect of water quality. Ground water quantity management is essential for the added reason that ground water is often an important component of streamflow.

Water quantity management in Ontario involves a combination of common law, land patent, and federal and provincial statutes. The main involvement of the Ministry of Environment and Energy in this field is through the water taking permit system under the Ontario Water Resources (OWR) Act. Specific details are contained in "Permit To Take Water Program Guidelines and Procedures Manual", MOEE, 1984.

Recognizing the many and varied uses of water, the MOEE policy for the management of water quantity is:

Policy 7

"To ensure the fair sharing, conservation and sustainable use of the surface and ground waters of the province."

5.1 Guidelines Common to Surface and Ground Water

Many water quantity management guidelines and procedures are common to both surface and ground water and are summarized in this section. Requirements that are specific to either surface water or ground water are contained in Sections 5.2 and 5.3, respectively.

5.1.1 Permits To Take Water

Guideline

"Water takings will be controlled to prevent interference with other uses of water wherever possible and to resolve such problems if they do occur."

Under the Ontario Water Resources Act, the Ministry of the Environment and Energy administers a water permit program, under which most takings in excess of 50,000 litres in a day require authorization by means of a Permit to Take Water. This includes temporary takings such as withdrawals from a well for purposes of a pumping test.

Takings which are generally exempt from the water permit legislation, but which are found to interfere seriously with other users, can be prohibited without a permit and thus brought under the provisions of a water permit. The only exception to this provision is the taking of water by an individual for ordinary household purposes, livestock watering, and fire fighting.

An application for a water permit is reviewed in light of information concerning the availability of the supply, the use to which the water is to be put, and the effects of the proposed taking on existing uses. Permitees may be required to keep records of the withdrawals.

When evaluating the relative priority of uses in an area where there is insufficient water to meet established and new uses, the taking of water for private domestic and farm purposes is considered the most important use, generally followed by municipal water supply. The taking of water for industrial, commercial and irrigation purposes is regulated by the availability of the supply, the efficiency of use and established uses in an area. The use of water for pollution control, flood control, fire protection, recreation, wildlife preservation and the protection of habitats are also important considerations.

5.1.2 Water Quality/Quantity Inter-relationships

Guideline

"Surface and ground water withdrawals, and the discharge of water to surface water bodies will be controlled to assist in maintaining or restoring water quality for the protection of aquatic ecosystems and recreation and to provide for downstream withdrawal uses."

Water takings should be controlled to avoid water quality impairment as well as to protect

withdrawal uses. Under appropriate conditions, streamflow augmentation from either surface or ground water sources may be considered as a supplementary means of maintaining water quality. Controls on land-use practices, discharges of water from urban drainage, and agricultural drainage and similar artificial discharges will be encouraged to prevent water quality degradation and to minimize any increase in peak flows.

5.1.3 Water Conservation

Guideline

"All reasonable and practical measures should be taken to conserve the quantity of surface and ground water to sustain ecosystem integrity and to maximize its availability for existing or potential uses."

In flowing well areas, appropriate management practices incorporating site-specific considerations should be undertaken to conserve ground water and thereby protect streamflows. Where a new flowing well is constructed, a flow control device must be installed in accordance with the requirements of Ontario Regulation 903.

Explicit statements respecting water conservation should be incorporated into appropriate planning documents and all parties proposing or reviewing proposed projects in such areas should ensure that appropriate conservation measures are undertaken.

5.1.4 Surface/Ground Water Quantity Inter-relationships

Guideline

"The importance of the inter-relationships between surface and ground water quantity will be taken into account in water quantity management decisions."

If the taking of water from wells causes interference with streamflow, restoration of supplies is required if serious interference with surface water uses occur.

Ground water takings that impact streams will be allowed only after due regard to the maintenance of sufficient streamflow to protect both in-place and withdrawal uses downstream.

5.2 Additional Provisions - Surface Water Quantity Management

While the water permit legislation is designed to manage the use of water resources in the Province, riparian rights are not superseded, but may be limited in some cases by the water permit legislation.

Permits for stream takings shall contain a requirement that the taking of water be carried out in such a manner that downstream flow is not stopped or reduced to a rate that will interfere with

downstream uses of water or the natural functions of the stream. A permit for a taking from any surface waterbody shall contain a requirement that if the taking interferes with the use of water by other persons, the terms and conditions of the permit may be altered.

Other special terms and conditions relating to a taking may be stipulated on a case-by-case basis to deal with special circumstances.

When water is taken from streams which cease to flow seasonally due to natural causes, downstream flow must be maintained whenever there is an inflow. The release of water from storage to maintain downstream flow is not required when there is no inflow.

With respect to the taking of cooling water, the design and location of the water intake must be such that entrainment of fish, including larval fish and eggs, and other aquatic life is minimized.

5.3 Additional Provisions - Ground Water Quantity Management

If a ground water taking authorized by permit interferes with other water supplies obtained from any adequate sources that were in use prior to the issuance of the permit, the permittee shall restore the affected supplies or reduce the taking so as to eliminate the interference.

The free flow from a flowing well is not protected in the event of interference by another ground water taking. In the event of interference with a flowing well supply, restoration of the supply is required, provided that the well was equipped with at least a shallow-well pump having an adequate intake located in the portion of the well that is in direct hydraulic connection with the water-bearing formation. Furthermore, the well had to be capable of meeting the daily water demands on a continuous basis by a combination of its storage, water yielding and pumping capabilities, prior to interference.

The restoration of a water supply is not required in an area where a property has community water service available if the interference is caused by the construction or operation of works for the improvement and service of the community, such as municipal wells, sewers, water mains, roads and bridges. Where interference in a water serviced area is caused by an operation not associated with a community improvement, restoration of a water supply is required.

Parties causing short-term interference with existing supplies where water service is or is not available are required to make available a temporary supply of water to those experiencing interference. This applies to interference resulting from such operations as pumping tests, excavation dewatering, and other short-term water takings.

Ground water encountered during construction projects and excavations where ground water may flow by gravity either out of the excavation or along granular trench bedding can cause serious interference with water supplies by lowering well water levels. The person whose works cause the problem may be required by notice under Section 34 of the OWR Act to stop or control the

leakage or to take such measures as the notice may require, such as to restore the affected supply.

Artificial ground water recharge should be encouraged wherever practical to conserve ground water.

Protection of areas with high infiltration rates is generally a good management practice. In evaluating proposals for development in significant infiltration areas, the effects on infiltration rates and the quality of the infiltrating water should be considered.

GLOSSARY

Acute Toxicity - An adverse response, ranging from injury to death, following exposure of short duration relative to the normal lifespan of the organism.

Additive Effects - Toxic interactions of two or more substances on organisms producing a result such that the total effect approximately equals the sum of the individual effects.

Aesthetic - Dealing with those aspects of water that are perceived by the senses (e.g. taste or odour).

Assimilative Capacity - the limit of a waterbody to transform and/or incorporate substances (e.g. nutrients) by the ecosystem, such that the water quality does not degrade below a predetermined level.

Background Water Quality - The physical, chemical and/or biological conditions of a waterbody at a point upstream/up current of a polluting source. The establishment of background water quality may be based on historical data or on water quality in a similar, unaltered waterbody.

Ban - Prohibition of the use or release to the environment of specific substances judged to be particularly hazardous. Bans would normally be applied on a provincial or national basis.

Best Available Treatment Technology - can include, in order of preference - changes in production processes, chemical substitution, in-plant controls, best management practices, water conservation, waste treatment technologies, energy conservation.

Bioaccumulation - the process by which chemicals are amassed by organisms from water directly or through the consumption of food containing the chemicals.

Certificate of Approval (C of A) - A legal document issued, at a proponent's request, by a Designated Director of the Ministry of Environment and Energy under the authority of the Ontario Water Resources Act. C of A's may include effluent requirements and monitoring requirements.

Common Law - Law which relies for its authority on the decision of courts and is recorded in law reports as the decisions of judges along with the reasons for their decisions, as opposed to law established in a statute.

Compliance - A state achieved by adhering to the legislative and regulatory requirements of the Ontario Ministry of Environment and Energy. These requirements cover a wide range of activities, from the prevention, reduction and elimination of pollution, to the obtaining of approvals and licences, to the completion of routine paperwork and the filing of reports.

Contaminant - A substance which, once in the water, may pose a threat to the ecosystem and/or human health, as well as uses such as water supply, recreation, and aesthetic conditions.

Control Order - A document that requires the discharger to take specific action with an associated deadline. It is authorized by statute, binding upon the recipient, and directly enforceable by prosecution.

Conventional Pollutants - Traditional indicators of environmental quality including BOD, nutrients and solids.Materials defined as hazardous substances are not included in this category.

Effluent - the wastewater discharged to a receiving water body.

Effluent Limit - A legally enforceable effluent requirement.

Entrainment - The incidental capture of aquatic organisms in water being extracted (e.g. pumped) from a natural waterbody.

Flowing Well - a well in which the static water level is above ground level.

Hazardous Substances - chemicals that are persistent, bioaccumulative and extremely toxic. They including substances which, individually or in combination with other substances, can cause death, disease including cancer, behaviourial abnormalities, genetic mutations, physiological malfunctions and/or physical deformities.

Implementation Procedures - A set of activities required for the appropriate execution of a Water Management policy or guideline.

Irreversible Man-induced Conditions - An existing condition impairing water quality and/or uses caused by human activity. The actions are such that natural conditions cannot practically be restored. Examples might include removal of old-growth forest or urbanization.

Land Patent - A grant of land from the Crown under the Great Seal which may retain some interests in the land for the Crown.

Natural Background Water Quality - Chemical, physical and biological quality of a waterbody, if unaffected by human activity.

Non-indigenous - Not native or not belonging naturally to an area.

Non-point Source - A non-specific or diffuse source entering the aquatic environment. Commonly, any source that cannot be described as a point source. Usually, this type of source is not amenable to collection and, if necessary, treatment.

Objectives - Provincial Water Quality Objectives

Parameter - A measurable or quantifiable characteristic or feature of water quality.

Permit to Take Water - A permit issues by a designated Director of the Ministry of Environment and Energy, authorizing the taking of surface or ground water in excess of 50,000 litres per day as provided for under the Ontario Water Resources Act.

Permittee - The individual or group to whom a permit has been granted.

Persistence - Longevity in the environment usually expressed as half-life.

Persistent Pollutant - A substance with an environmental half-life in excess of 50 days.

Point source - A source of pollution that is discharged to the environment at a specific location. It is quantitatively and qualitatively definable.

Pollution Prevention - Any action which eliminates or reduces the creation of pollutants or waste at their source through measures such as substitution/reduction in use of a raw product, production redesign, process change, in-process recycling and/or improved maintenance and operating procedures.

Receiving Water - A waterbody to which a discharge is directed.

Remedial Actions - Actions undertaken to upgrade water quality and restore uses to a waterbody previously impaired. Initial actions are usually to eliminate or reduce the source(s) of the problem and can include physical intervention (e.g. dredging, artificial aeration, flow augmentation, etc.)

Riparian Rights - The common law rights of owners of property along a river or shore of other bodies or water. These rights include, stated generally, the right to make reasonable use of the water flowing past their land.

Streamflow Augmentation - The addition of water, often from reservoir storage or groundwater, to a river or stream to increase its base flow.

Sustainability - The utilization of a resource in a manner that the resource will be adequately protected for indefinite future use.

Surrogate - A convenient and/or practical substitute

Toxic substance - A substance capable of producing an adverse response, ranging from injury to death, in a living organism

Toxicity - An adverse response, ranging from injury to death, in a living organism.

Waste - any solid, liquid, gas, odour, heat, sound, vibration, radiation or combination of any of them resulting directly or indirectly from the activities of man which may: impair the quality of the natural environment for any use that can be made of it; cause injury or damage to property or to plant or animal life; cause harm or material discomfort to any person; adversely affect the health or impair the safety of any person; or render any property or plant or animal life unfit for use by man.

Water Conservation - Preservation of the quantity of available water through judicious use, reuse and minimal wastage.

Waste Assimilation - (See Assimilative capacity)

Watershed - The area of land drained by a river/stream and its tributaries.

APPENDIX C12

Interim Position On Clean-Up of Contaminated Sites In Ontario

Ministry of the Environment and Energy

INTERIM POSITION ON THE CLEAN-UP OF CONTAMINATED SITES IN ONTARIO

JULY 1994

The Ministry of Environment and Energy (MOEE) has developed a revised guideline for clean-up and restoration of contaminated sites in Ontario. The "Proposed Guideline for the Clean-up of Contaminated Sites", 1994 (Proposed Guideline), and supporting documentation will be released during July 1994, for public review and comment. The Minister of the Environment and Energy (Minister) has asked the Advisory Committee on Environment Standards (ACES) to manage the public review of the Proposed Guideline. This independent committee reports directly to the Minister. Public review comments will be received and consolidated by ACES, and ensuing recommendations will be presented to the Minister in the autumn of 1994. The ACES office may be contacted at (416-314-9265).

Table 1 (attached) provides guidance specific to use and development of criteria for site clean-up and restoration, during the public consultation process. Table 1 makes reference to criteria included in the Proposed Guideline. In developing the Proposed Guideline, the Ministry consulted a number of jurisdictions, and have complied clean-up criteria protective of human and environmental health, appropriate for general use in Ontario. This expanded criteria set is presented in Table A of the Proposed Guideline. These criteria may be used in current soil and ground water clean-up activity, as described in Table 1 and Table A.

> NOTE: when criteria for a parameter is provided in an existing Ministry guideline and in Table A (Proposed Guideline), the existing Ministry criteria should be used.

Proponents, alternatively, may develop site specific clean-up criteria, protective of human and environmental health, through a risk analysis (Table 1, Option C). The analysis must consider and incorporate, as appropriate, specific exposure characteristics and conditions reflective of the intended site use. To ensure that future site conditions and the assumptions under which criteria were developed remain intact and, therefore, protective, administrative requirements as outlined under Option C must be met.

INTERIM POSITION ON
THE CLEAN-UP OF CONTAMINATED SITES IN ONTARIO

JULY 1994

During the public consultation period for the "Proposed Guideline for the Cleanup of Contaminated Sites in Ontario", (Proposed Guideline), proponents should continue to use the guidance and criteria provided in the "Guidelines for the Decommissioning and Cleanup of Sites in Ontario" February 1989 (Guideline), and the "Interim Guidelines for the Assessment and Management of Petroleum Contaminated Sites in Ontario" August 1993 (Interim Guideline), for full site clean-up.

If applicable or appropriate clean-up criteria are not available from Tables A-1, or A-2 of the Guideline, or the Interim Guideline, then the proponent may either; (A) use other applicable Ministry criteria (Guideline, S.7.5.2.1), or (B) propose criteria from another jurisdiction (Guideline, S.7.5.2.2), or (C) develop site specific criteria (Guideline, S.7.5.2.3).

Option (A)

Other applicable Ministry criteria include: Table A (Proposed Guideline) for soil (full depth) and ground water (potable) criteria; Table E (Proposed Guideline) for sediment criteria; Table F (Proposed Guideline) for soil "background" concentration criteria.

or

Option (B)

When proposing use of criteria from another jurisdiction, the proponent must provide documentation to demonstrate that (1) the methods used to develop the criteria are acceptable to MOEE; (2) that the proposed application of the criteria is consistent with the intended application as developed, i.e. required controls are in place; and (3) the criteria are protective of environmental and human health (Guideline, S.7.5.2.2).

or

Option C

The following conditions apply to the development and application of site specific clean-up criteria (Guideline, S.7.5.2.3):

- ✓ proponent warrants registration of applicable information on land title to MOEE
- ✓ proponent secures peer review of supporting documentation prior to MOEE review
- ✓ proponent secures municipal concurrence with the approach
- ✓ proponent warrants that required administrative land use controls are in place
- ✓ Proponent ensures and warrants that administrative requirements of any risk management measures are maintained for the required duration of the measure

APPENDIX C13

Guidelines For The Decommissioning And Cleanup of Sites In Ontario

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GUIDELINES FOR THE DECOMMISSIONING AND CLEANUP OF SITES IN ONTARIO

Report prepared by:

Waste Management Branch
Ontario Ministry of the Environment

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Appendix B Approaches to Sampling

Appendix C Selected Provincial Environmental Legislation Relevant to Decommissioning and Site Clean-Up

1. Introduction

These Guidelines have been prepared to provide for an efficient and effective process to decommission facilities and clean-up the environment. The Guidelines detail a process for meeting MOE requirements and outline management and technical procedures in this regard. Experience from one decommissioning or clean-up will be applied to subsequent decommissionings and clean-ups. Where possible, points in the decommissioning and site clean-up process have been identified at which public consultation requirements and the requirements of other agencies may need to be met.

2. Definitions

Throughout this document, the terms "decommission" and "decommissioning" are used to mean the mothballing, partial closure or complete closure of facilities.

The term "clean-up" means the restoration of a contaminated site to ensure the protection of human health and the environment. The decommissioning of facilities may or may not be associated with site clean-up.

3. Purpose

The purpose of these Guidelines is to:

1) ensure that the decommissioning and clean-up of sites is completed in an environmentally acceptable manner;

2) communicate to decommissioning and site clean-up proponents and the public the requirements and policies of the Ministry of the Environment (MOE) and identify potential involvement of other agencies;

3) ensure that the decommissioning and clean-up of sites in Ontario proceeds in as efficient, fair and consistent a manner as possible; and

4) ensure public involvement in the decommissioning and site clean-up process.

4. Scope, Application and Notification

4.1 Scope

There are three types of decommissioning: mothballing, partial dismantling and complete dismantling. These Guidelines should be used under any of these scenarios. Facility abandonment is not an acceptable alternative.

These Guidelines may also be used, as appropriate, where remedial action may be necessary to clean-up a site but where the decommissioning of facilities is not being undertaken or is complete, e.g., remedial actions taken with respect to contaminants at coal gasification and other historically contaminated sites.

In addition, the Guidelines may also be used when industrial and other sites are offered for sale, even if a decommissioning is not involved. Prospective purchasers may use the Guidelines to assist in minimizing their risk of assuming environmental liabilities when they purchase a site.

4.2 Application

The Guidelines can apply to all provincially, municipally and privately owned sites and facilities to be closed down at which environmental contamination may have taken place. This includes industrial facilities, transportation facilities and institutions such as hospitals and laboratories. The Guidelines include the broad range of activities that may be required to decommission or clean-up a site. However, not all decommissionings or site clean-ups need necessarily involve all the tasks outlined in this document.

These Guidelines do not apply to waste disposal site closure or to the closure of other facilities that are required to meet either closure conditions in fulfilment of a MOE certificate of approval or terms and conditions attached to an Environmental Assessment Act Exemption Order, except to the extent the Guidelines are made applicable by an order or approval. Federal standards and requirements will normally apply to facilities that are decommissioned on federal property. Where there are federal and Ontario decommissioning or site clean-up guidelines/standards, the more stringent should apply in decommissioning or cleaning-up these facilities.

4.3 Notification

MOE may become aware of plant decommissionings in two ways. Under the Employment Standards Act, companies are required to inform the Ministry of Labour (MOL) of all employment terminations involving 50 or more employees. MOL has agreed to routinely make this information available to the Waste Management Branch of MOE. Where such employment terminations are a result of plant closures, Waste Management Branch will notify the appropriate Regional

Office. Alternatively, Regional staff may become aware of decommissionings that do not involve employment terminations requiring reporting to MOL.

5. Legislative Context To Decommissioning and Site Clean-Up

5.1 Environmental Legislation

The environmental concerns associated with decommissioning and site clean-up should be addressed through the Environmental Protection Act (EPA), Environmental Assessment Act (EAA) and the Ontario Water Resources Act (OWRA). As a matter of policy, MOE staff should use EPA provisions such as Section 17 to issue orders to enforce the decommissioning or site clean-up process when proponents are unwilling to meet MOE decommissioning or site clean-up objectives or timeframes.

Two Regulations issued under the EPA are also relevant: Regulation 308 details requirements related to the emission of contaminants to the atmosphere; Regulation 309 regulates waste management in general.

Appendix C summarizes the relevant provincial environmental legislation and Regulations, administered by MOE, that are most commonly applicable to decommissioning and site clean-up. Projects and plans subject to the Environmental Assessment Act must address decommissioning as part of the environmental assessment process.

In addition to provincial legislation, environmentally-related municipal by-laws may also apply. In particular, relevant by-laws are likely to regulate discharges to storm and sanitary sewers, and noise from construction activity. There may also be other by-laws that bear on decommissioning or site clean-up in any particular municipality. Conservation Authorities and federal agencies may have requirements to be met.

5.2 Other Legislation

Other provincial, municipal and federal legislation may also apply to a site decommissioning or clean-up. These requirements may pertain to planning, public notice, protection of environmentally sensitive areas, posting by Ministry of Health, occupational health and safety, or the size of vehicles on city streets, for example.

6. Environmental Components of a Decommissioning or Site Clean-Up Program

6.1 General

Decommissioning and site clean-up should be conducted according to a planned process comprised of separate phases. Each phase has objectives, which are met by completing individual tasks and activities. Decommissionings and site clean-ups typically have the following phases:

- Phase I - Planning the Decommissioning/Site Clean-Up
- Phase II - Designing and Implementing the Decommissioning/Site Clean-Up
- Phase III - Verifying Completion of a Satisfactory Decommissioning/Site Clean-Up
- Phase IV - Signing off

MOE district offices will take the MOE lead role in liaising with decommissioning and site clean-up proponents. MOE Waste Management Branch will provide technical and policy assistance to district offices. Communication should be established with MOE district offices as early as possible in the decommissioning or site clean-up process and maintained until a satisfactory decommissioning or site clean-up has been verified. All data relevant to the decommissioning or site clean-up should be reviewed by MOE on an ongoing basis. For decommissioning or site clean-ups with many components, regular progress reports will be required by MOE. Other concerned parties, including the public, should be consulted regarding the decommissioning or site clean-up as it proceeds.

6.2 Timing

Proponents of a decommissioning or site clean-up should establish a timing schedule that accommodates all environmental requirements of the decommissioning or site clean-up. The timing schedule must anticipate reviews and revisions of decommissioning or site clean-up requirements as the decommissioning or site clean-up proceeds and should be sufficiently flexible to accommodate unexpected problems.

7. Phase I Activities

Phase I involves the planning of the decommissioning or site clean-up. Four major tasks should be undertaken.

7.1 Corporate Commitment

A corporate commitment to complete the decommissioning or site clean-up in an environmentally acceptable manner may be demonstrated by a directive issued by the company president or the executive responsible for administering the decommissioning or site clean-up. This approach is effective in communicating to government agencies and the public, as well as corporate personnel, the commitment to fully resolve all environmental issues related to the decommissioning or site clean-up.

7.2 Initial Documentation

Initial documentation of the site to be decommissioned or cleaned-up should be forwarded to the local MOE office, other government agencies, such as the Ministry of Labour, and the municipality. Initial information submitted to MOE regarding the decommissioning or site clean-up should include: a general description of the facilities to be decommissioned; a site plan to scale, also showing surrounding land uses and natural features; the approximate time frame envisaged for the decommissioning or site clean-up; and the current official plan designation and zoning of the site. Any proposed changes to the official plan designation or zoning by-laws should also be included.

MOE and other agencies can assist in initial decommissioning or site clean-up planning by providing information on decommissioning or site clean-up requirements, interpretation of applicable legislation and specific issues to be addressed.

7.3 Public Communications and Consultation

Proper communication of decommissioning or site clean-up activities to appropriate citizens' groups, public interest and environmental groups and the media is an essential component of decommissioning and site clean-up activities. Therefore, a public communications strategy which includes public consultation should be developed by the proponent and reviewed with MOE. A publicly available file should be created, containing records of all significant decisions taken with respect to milestones, deadlines, levels of contamination, proposed remedial actions, verification and confirmation of site clean-up and other aspects of a decommissioning. To facilitate public consulta-

tion, consideration should be given to establishing a public liaison committee comprised of representatives from all agencies participating in the decommissioning or site clean-up and the public.

A well planned, comprehensive communications and public consultation strategy will result in an informed public, which will facilitate the decommissioning and site clean-up process.

7.4 Preliminary Inventory

At facilities to be decommissioned, a preliminary inventory of potential contaminants and contaminant sites should be drawn up. This will identify if clean-up is required and will provide an initial understanding of the range and quantity of contaminants and contaminated materials likely to be found on-site.

There are a number of sources for obtaining preliminary contaminant information. Historical records, such as archives and maps, should be reviewed to establish any previous land uses that may have caused contamination; inventory, production and process modification records should be checked and chemical raw materials and wastes identified; loading and unloading areas should be plotted; above ground and underground storage tanks and pipeline locations should be defined; and records of on-site waste disposal locations and spills should be noted. Discussions should be held with both past and present plant personnel regarding potential contaminant locations.

A preliminary sampling program to identify on-site soil contaminants should be undertaken at this point. Where appropriate, a preliminary sampling program of surface and ground water should also be undertaken. If contaminants that can migrate off-site or volatize are suspected, the initial sampling program should be extended for verification.

7.5 Level of Clean-Up

In principle, remedial action will be required wherever contaminants are present at concentrations above ambient background levels. The development of clean-up criteria above background levels, however, may be undertaken by the proponent in accordance with the factors outlined in Section 7.5.2 and the land-use considerations described in Section 7.5.3.

7.5.1 Determination of Background Levels

"Background level" is defined as the ambient level of a contaminant in the local area. Determination of this level will generally require a sampling program. Where a wide range of contaminants are present on-site, it may be acceptable to select indicator contaminants to represent the range of contaminants at the site; in this case, background levels would be determined with respect to these contaminants only. Selection of indicator contaminants must be done in consultation with MOE.

In some situations, background levels of contaminants of concern may themselves be unacceptably elevated in the local area as a result of industrial or other activity. Where this is the case, background levels in soils can be defined according to the Upper Limits of Normal Concentrations in Soils data that have been developed by MOE for a variety of parameters (see Appendix A). Background levels in water should be defined according to the objectives outlined in "Water Management: Goals, Policies, Objectives and Implementation Procedures of the Ministry of the Environment" (see Appendix A).

If background levels of contaminants of concern are unacceptably elevated in the local area and appropriate data do not exist in the above sources, a sampling program should be undertaken to determine background levels of the contaminants of concern at a representative location outside the local area.

7.5.2 Development of Clean-Up Criteria Above Background Levels

Clean-up criteria above background levels may be developed provided that the criteria are protective of human health and the environment. There are three general approaches that may be taken to developing clean-up criteria above background levels:

1) application of relevant MOE policies, and guidelines;

2) application of clean-up criteria developed in other jurisdictions, where appropriate;

3) development and application of site specific clean-up criteria.

Where a wide range of contaminants are present on-site, it may be acceptable to develop clean-up criteria above background levels based on indicator contaminants that represent the range of contaminants at the site. Selection of indicator contaminants must be done in consultation with MOE.

7.5.2.1 MOE Contaminant Policies, Guidelines and Requirements

The Ministry of the Environment has developed:

1) clean-up guidelines for several contaminants in soils;

2) objectives for water quality and drinking water quality;

3) policies and guidelines related to resolving groundwater quality problems and the application of the reasonable use concept to groundwater management;

4) a regulation governing the emission of atmospheric contaminants.

These policies, guidelines and requirements are outlined in Appendix A and may be used, as appropriate, to assist in developing criteria levels above background levels. Clean-up guidelines for additional contaminants, particularly organics, will be included in Appendix A as they are developed or adopted for use in Ontario.

7.5.2.2 Clean-Up Criteria Developed In Other Jurisdictions

Where MOE contaminant criteria guidelines for the contaminants of concern are not available to assist in clean-up criteria development, it may be possible to

apply clean-up criteria developed in other jurisdictions. In order to apply clean-up criteria developed in other jurisdictions at a site in Ontario, the following factors should be taken into consideration:

1) the methods used to develop the criteria must be acceptable to MOE;

2) the proposed application of the criteria must be consistent with the application intended when the criteria were developed;

3) the criteria should be consistent with MOE's overall objective of establishing stringent criteria that are fully protective of human health and the environment.

It is the proponent's responsibility to provide the information necessary to allow MOE to make a decision regarding the acceptability of criteria developed in other jurisdictions at a site in Ontario. The application in Ontario of criteria developed in other jurisdictions will only be permitted where the application of the criteria is consistent with Ontario legislation, policies and guidelines.

7.5.2.3 Site Specific Clean-Up Criteria

Where MOE clean-up criteria guidelines have not been developed, or where acceptable criteria are not available from other jurisdictions, the development of site-specific clean-up criteria may be undertaken. This must take into consideration the following factors:

1) environmental and human health toxicology of the contaminants;

2) mobility of the contaminants of concern;

3) the pathways by which the contaminants of concern may impact on

human health or the environment, with respect to the anticipated future zoning of the site;

4) the combined effects of the contaminants of concern.

5) the physical features and environmental conditions of the site, including background concentrations of contaminants. ..

The development of site-specific criteria may be complex and MOE must therefore review each stage of the work required to develop the criteria. It is the proponent's responsibility to provide the information necessary to allow MOE to make a decision regarding the acceptability of proposed site-specific criteria.

7.5.3 Proposed Future Land-Use

If clean-up criteria above background levels are proposed, specific reference must be made to a future land-use of the site that is compatible with existing or proposed neighbouring land-uses. If an immediate future use has not been determined, one of the following generic uses will be assumed, consistent with the existing or proposed zoning of the site.

1) Agricultural

2) Residential

3) Parkland

4) Commercial

5) Industrial

Generally, more stringent clean-up criteria will be required for agricultural, residential and parkland redevelopment than for commercial or industrial redevelopment. Where clean-up criteria above background levels are developed on the basis of one type of site reuse, but zoning or official plan changes are proposed in the future that would permit other types of site reuse, MOE will recommend that the proposed changes not occur until the Ministry has

reviewed and determined the need for additional remedial measures at the site.

7.5.4 Application of Clean-Up Criteria

Clean-up criteria should be used to define areas of contamination requiring remedial action. If background levels are adopted as on-site clean-up criteria, remedial action will be required with respect to on-site contamination above background levels. If clean-up criteria above background levels are developed, remedial action will be required with respect to on-site contaminant levels in excess of the criteria. Aesthetic parameters, such as odour, must be addressed regardless of the clean-up criteria.

7.5.5 Criteria and Background Level Review and Public Consultation

While proponents should be encouraged to develop clean-up criteria or background levels in consultation with MOE and other agencies such as the Ministry of Health, local Medical Officer of Health, the Ministry of Labour and the municipality, this will not preclude the need for the criteria or background level definitions to undergo formal review by the above agencies once they are proposed for adoption.

Where appropriate, the public should also be able to review the proposed criteria or background level definitions, in conjunction with other Phase I work, prior to decisions being taken regarding the acceptability of criteria or background levels. A notice can be placed in all newspapers serving the community adjacent to the decommissioning or contaminated site announcing the availability of the proposed criteria or background level definitions and how they may be obtained.

A public comment period of at least 30 days from publication of the newspaper notice should be allowed prior to any decisions being made regarding the acceptability of the proposed criteria, background level definitions or remedial actions required. Where public meetings are held, a longer public review period may be necessary.

8. Phase II Activities

Phase II involves the design and implementation of a remedial work program.

8.1 Design of Remedial Work Program

The objectives of this task are to conduct an in-depth analysis of all on-site factors relating to the decommissioning or site clean-up and to develop an action plan to decommission and/or clean-up the site with these factors in mind.

8.1.1 Sampling Program

A comprehensive sampling program may be necessary to establish in detail the extent of contamination at the site. The sampling program should include detailed contaminant investigation of soils, groundwater and surface water, and atmospheric emissions, as appropriate to the site.

It may be necessary to extend the sampling program to add detail to the data gathered in Phase I on the physical features and environmental conditions of the site. The sampling program should also be extended to adjacent, off-site areas where there is a reasonable expectation that off-site contaminant migration may have occurred. A geomagnetic scan of the entire site should be made to locate any unknown buried drums or other containers that may contain contaminants. Appendix B provides information on sampling procedures acceptable to MOE.

If the sampling program reveals significant additional contaminants or other data to those identified during the preliminary inventory, this should be communicated to all parties and agencies involved in the decommissioning or site clean-up. Clean-up criteria should be modified, as appropriate, in consultation with the appropriate regulatory agencies and the public.

8.1.2 Remedial Work Plan

The remedial work plan will determine the measures necessary to clean-up or control all areas of contamination in excess of the clean-up criteria and to

safely close out or dismantle on-site facilities.

There are three general approaches that can be taken to manage contaminated and other waste materials:

1) on-site management, including on-site recycling/reuse, treatment, storage or control, and thermal destruction;

2) removal for off-site recycling/reuse, treatment, storage or disposal; and

3) on-site isolation.

MOE approval of on-site management of contaminated and other waste materials may be necessary; local MOE offices can advise proponents in this regard. Materials requiring disposal must be classified and managed according to the requirements of the Environmental Protection Act (EPA) and Regulation 309 of the EPA.

Any waste left on-site that is classified as "hazardous" under Regulation 309 must either be managed in appropriately approved facilities or must be delisted according to the provisions of the Regulation and disposed of in an approved non-hazardous waste landfill. Where land has been used for the disposal of waste, application may be made to the Ministry under Section 45 of the EPA for approval of a specific proposed use of the land. This approval will only be given if the proponent can demonstrate that human health or environmental problems will not result from the proposed use.

In some cases, it may be necessary to isolate contaminants on site; this may involve fencing off contaminated areas and prohibiting disturbance of the land until additional clean-up or control measures can be taken. The mixing or dilution of contaminated materials with uncontaminated materials is not to be permitted except in exceptional circumstances and with prior written Ministry approval. A certificate of approval may be required for such activities.

Contingency plans should be developed, as necessary, in case of emergencies resulting from the remedial action. Occupa-

tional health needs should also be identified at this point in consultation with the Ministry of Labour. Any requirements for on-going environmental monitoring following the decommissioning or site clean-up should also be identified.

8.1.3 Selection of Remedial Action Technology

Technologies selected for undertaking remedial actions at a site should be those that best protect human health and the environment while meeting MOE policies and objectives and satisfying site-specific remedial requirements.

Generally, for example, approaches that include the recycling/reuse and on-site management of wastes will be preferred over other approaches, provided site-specific remedial requirements are also achieved.

8.1.4 Remedial Work Plan Approvals and Financial Assurance

Where either an MOE approval is required to complete a decommissioning or site clean-up, or an Order has been issued with respect to a decommissioning or site clean-up, the Ministry may require financial assurance to be posted by the proponent, in accordance with Part X-A of EPA. The assurance may be drawn upon by MOE to undertake any terms or conditions of an approval or Order that the proponent fails to complete.

8.1.5 Remedial Work Plan Review

The remedial work plan should be reviewed by MOE and other agencies prior to implementation to ensure that Ministry and other agency objectives will be met.

All information relating to the remedial work plan should also be made publicly available. Consideration should be given to issuing for public review drafts of any Orders or Certificates of Approval required to conduct the decommissioning or site clean-up. A notice announcing the availability of this information should be placed in all newspapers serving the community adjacent to the site to be decommissioned or cleaned-up. Public confidence in the proposed decommissioning or site clean-up may be

increased by holding an on-site "open house" where the public is introduced to the site and where the proposed plan for the decommissioning or site clean-up can be discussed.

Implementation of the remedial work plan should not begin until 30 days following the newspaper notice; in complex decommissionings or site clean-ups, or where public meetings are required to discuss the remedial work plan, a longer public review period may be required.

8.2 Implementation of Remedial Work Program

The implementation of the remedial work program requires undertaking all activities necessary to complete the plan developed above.

8.2.1 Communication With Site Personnel

Key decommissioning and site clean-up personnel and contractors should be advised by the proponent of the requirements and objectives of the Ministry, other agencies and the proponent. This will help ensure that the decommissioning or site clean-up proceeds as rapidly and efficiently as possible and will minimize the possibility that additional work will be required due to an initial failure to meet objectives.

8.2.2 Operation of Equipment and Processes

All existing pollution abatement equipment, procedures and processes required for decommissioning or site clean-up purposes must be maintained and operated in accordance with their certificates of approval or permits throughout the decommissioning or site clean-up. Depending on the decommissioning or site clean-up, it may be necessary to adjust monitoring/treatment to ensure that batch discharges are not elevated above permissible levels.

8.2.3 Removal of On-Site Facilities

The final disposition of all on-site facilities, including buildings, storage tanks, underground storage tanks, pipes and other underground facilities relating to the decommissioning or site clean-up must be addressed during the development of the remedial work plan.

Removal of these materials must be to appropriately approved facilities.

9. Phase III Activities

Phase III involves verifying that the decommissioning or site clean-up has been satisfactorily completed, establishing and maintaining monitoring systems, and communicating the completion of the decommissioning or site clean-up to all relevant agencies and groups.

9.1 Verification

Following the completion of decommissioning or site clean-up activities, the proponent must undertake a verification sampling program to establish that the objectives of the environmental aspects of the decommissioning or site clean-up have been achieved. This sampling program need not be as extensive as the Phase II sampling program, but must be sufficiently detailed to establish that satisfactory clean-up has been achieved over the whole site.

The results of the verification sampling must be made available to MOE, other agencies and the public for review. MOE will conduct its own verification sampling, as necessary, in addition to the sampling conducted by the proponent. If objectives have not been met, proponents will be required to undertake additional work necessary to meet the objectives.

9.2 On-Going Monitoring

In some cases, on-going monitoring of the site may be necessary in order to ensure that contaminant problems do not recur.

Where on-going monitoring is required, the proponent must provide for the operation, maintenance and funding of the monitoring system and must review these aspects of the system, as well as the technical adequacy of the system, with MOE. In order to ensure that on-going monitoring is properly conducted, either an approval or Order will be issued to the proponent outlining the terms under which on-going monitoring will occur. MOE will require regular on-going monitoring reports and will require additional remedial work if these reports indicate unacceptable contaminant impacts.

MOE may require the proponent to provide financial assurance in a form satisfactory to MOE, in accordance with Part X-A of EPA, to meet the

costs of on-going monitoring. The amount of such assurance will be decided by MOE according to site-specific needs. Under Section 18 of EPA, where decommissioned or cleaned-up land is sold, the new owner has assumed responsibility for maintaining the monitoring system and for any necessary future remediation, together with any outstanding financial obligations, unless the terms of the sale of the property indicate otherwise. The assumption of responsibility by a new owner does not relieve any previous owners or occupants of their responsibilities to the environment.

9.3 Communication of Completed Decommissioning

After verifying the decommissioning or site clean-up has been satisfactorily completed, all appropriate agencies should be notified of its completion. The completed decommissioning or site clean-up should also be communicated to the public and the availability of all information relating to the decommissioning or site clean-up should be announced by a notice in newspapers serving the community adjacent to the site. It may be desirable to hold an "open-house" so that all interested parties can see the completed decommissioning or site clean-up.

10. Phase IV Activities

Phase IV involves signing off the decommissioning or site clean-up. Documents registerable on the title of the property should be so registered. MOE will provide a written statement of the activities that have been undertaken during the course of the decommissioning or site clean-up and the level of clean-up achieved. Redevelopment of a site may require approval by MOE or other agencies.

10.1 Registration of Decommissioning or Site Clean-Up

Unless all contaminants have been removed to background levels, the fact that there are residual contaminants on the property should be recorded on the title to the property. One or more registerable documents may have been created as a result of the prior operations at the site or the clean up activities. These can be used for purposes of recording information on title. Where title is recorded under the Registry Act and there are no appropriate registerable documents an affidavit may be deposited on title setting out any remaining matters of concern.

The proponent should also prepare a report detailing the decommissioning or site clean-up. The report should include all details of the decommissioning, or site clean-up, which will be relevant to the subsequent use or occupation of the property, including contaminants found at the site and their concentration, contaminants remaining at the site and their concentration, and remedial and control measures taken. This report should be forwarded to the local Ministry of the Environment office and the appropriate municipal office. These actions will ensure that municipalities, developers, owners and others are aware of any potential future conflicts between proposed land-use and suitability of the property for the land-use.

MOE will require confirmation from the proponent's lawyer that these actions have been taken.

10.2 Statement of Completion of Decommissioning or Site Clean-Up

When all the above phases and tasks have been completed, as appropriate, MOE will, on request, provide a written statement outlining the activities and level of clean-up achieved at the site. This statement will indicate that it is based in large part on information supplied by the proponent and is for the proponent's own use. It in no way amounts to MOE accepting liability for any future environmental problems that may arise at the site; this rests with the property occupant and owner. The statement may contain, in outline, the nature of any initial contamination, work undertaken to clean-up and/or control contamination, the criteria used in the clean-up, and general future land uses that are appropriate for the site. A copy of the statement will be forwarded to the municipality.

10.3 Future Land Uses

Redevelopment of property that has been decommissioned or cleaned-up must be in accordance with the clean-up criteria and remedial actions applied at the site. Where the Ministry becomes aware of proposed site redevelopments that are not compatible with the clean-up criteria and remedial actions applied at the site, for example through its participation in the Official Plan review process, it will recommend the proposed redevelopment not occur until the applicant has provided sufficient information to the Ministry and the

Ministry has reviewed and determined the need for additional remedial measures at the site and such measures, if any, have been carried out.

Site redevelopment must be compatible with neighbouring land-uses. MOE and the municipality should be contacted regarding land-use compatibility policies.

APPENDIX D

GLOSSARY OF SELECTED TERMS

APPENDIX D

GLOSSARY OF TERMS

Base Flow: The sustained or fair weather flow of a stream whether or not affected by the works of man. (Glossary of Geology, Second Edition, Bates, R.L. and Jackson, J.A., editors, American Geological Institute, Falls Church, Virginia, 1980).

Ecosystem: A unit in ecology consisting of the environment with its living elements, plus the nonliving factors that exist in and effect it. (Glossary of Geology, Second Edition, Bates, R.L. and Jackson, J.A., editors, American Geological Institute, Falls Church, Virginia, 1980).

Ground Water Recharge: The entry into the saturated zone of water made available at the water table surface, together with the associated flow away from the water table within the saturated zone (Groundwater, Freeze, R.A. and Cherry, J.A., 1979).

Highly Permeable Soil: Soils which have very high infiltration rates (from MOEE Technical Guideline for Individual On-Site Sewage Systems: Water Quality Impact Risk Assessment, Autumn 1993).

Hydrogeologically Isolated:

Those areas characterized by strong upward hydraulic gradients: massive, unfractured clay deposits at or near ground surface; or other thick impervious layers of materials over water-bearing formations. (MOEE, Technical Guideline for Individual On-site Sewage Systems, autumn 1993).

Hydrogeologically Sensitive Environment:

Examples of such areas include, karstic areas, areas of fractured bedrock exposed at surface, areas of thin soil cover or areas of highly permeable soil (from MOEE Technical Guideline for Individual On-Site Sewage Systems: Water Quality Impact Risk Assessment Autumn 1993).

Individual On-Site Sewage System:

An on-site Class 4 or Class 6 sewage system regulated by Ontario Regulation 358 under the Environmental Protection Act. (MOEE, Technical Guideline for Individual On-Site Sewage Systems, Autumn 1993).

Karst:

A type of topography that has formed on limestone, gypsum and other rocks by dissolution, and that is characterized by sinkholes, caves and underground drainage. (Glossary of Geology, Second Edition, Bates, R.L. and Jackson, J.A., editors, American Geological Institute, Falls Church, Virginia, 1980).

Potable Water:

Water that is safe and palatable for human use. (Glossary of Geology, Second Edition, Bates, R.L. and Jackson, J.A., editors, American Geological Institute, Falls Church, Virginia, 1980).

Recharge Area: An area in which water is absorbed that eventually reaches the zone of saturation in one or more aquifers. (Glossary of Geology, Second Edition, Bates, A.L. and Jackson, J.A., editors, American Geological Institute, Falls Church, Virginia, 1980).

Supply Aquifer: Ground water which is or which may be used to provide domestic water supply(ies) (MOEE, Technical Guideline for Individual On-Site Sewage Systems, Autumn, 1993).

Watershed: The region drained by, or contributing water to, a stream, lake or other body of water. (Glossary of Geology, Second Edition, Bates, R.L. and Jackson, J.A., editors, American Geological Institute, Falls Church, Virginia, 1980).

Well Head Protection Areas: Areas designated -- for limited development or other protection to prevent ground water contamination. (From Case Studies in Wellhead Protection: USEPA 813-R-92-002, December 1992).

MOEE GUIDELINE D-5

IMPLEMENTATION GUIDELINE FOR PROVINCIAL POLICY STATEMENT B7: PLANNING FOR SEWAGE AND WATER SERVICES

ONTARIO MINISTRY OF ENVIRONMENT AND ENERGY

MARCH 1995

MOEE GUIDELINE D-5:
Implementation Guideline for Provincial Policy Statement B7:
Planning for Sewage and Water Services

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1.0 INTRODUCTION

1.1 Purpose

This implementation document is intended to guide municipal land use planning for sewage and water servicing such that planning decisions *shall be consistent with* Policy B7 of the comprehensive set of policy statements under Section 3 of the Planning Act, 1995. This guideline describes an implementation approach for municipal planning for servicing and infrastructure with a particular focus on sewage and water services. It outlines an approach which is consistent with Goal B, *to manage growth and change to foster communities that are socially, economically, environmentally, and culturally healthy, and that make efficient use of land, new and existing infrastructure and public service facilities.*

1.2 Rationale

The provincial interest in planning for services and infrastructure in land use planning is founded in the recognition that servicing and infrastructure provide support for development. In recognizing that servicing is inseparable from development, it follows that well-planned servicing leads to well-planned development and communities. Well-planned services can be built efficiently and used efficiently and avoid costs for later upgrading or rehabilitation that is common with poorly planned servicing. Planning for sewage and water services is particularly important to ensure that communities have a potable water supply and proper collection, treatment and disposal of sewage wastewater that protects the natural environment and public health. Planning for sewage and water services in land use planning allows the opportunity for servicing facilities to maintain or enhance the natural environment and accommodate expected growth in a manner that is cost effective and promotes efficient use of servicing facilities.

The Ministry of Environment and Energy has an interest in municipal planning for sewage and water services which stems from the Ministry's mandate in administering the Environmental Protection Act, 1990, Ontario Water Resources Act, 1990, and Environmental Assessment Act, 1990. The Ministry's responsibilities under these Acts include the approval and compliance monitoring of sewage treatment and water supply facilities. In order to protect the natural environment and public health it is imperative that land use planning decisions be made in the knowledge that proposed development can be accommodated in the long-term with sufficient and appropriate sewage treatment and a sufficient potable water supply in accordance with standards under environmental legislation.

1.3 Objectives

The objectives of this implementation guideline are to advise municipalities to plan for sewage and water services which maintain or enhance the quality of the environment while accommodating expected growth by:

- planning for and directing development to areas where municipal water and sewage facilities are available, with sufficient uncommitted reserve capacity to service the proposed development or to areas where there has been a commitment to new services or the expansion of existing services (where services will be available at the time of

development), in accordance with long-term planning as established through the principles the Comprehensive Set of Policy Statements;

- using communal water and sewage services where multi-lot/unit development is considered for areas without full municipal services to ensure the long-term viability of the services through municipal responsibility to protect the environment and public health; and

- determining, in the context of long-term planning and approved growth management objectives, that the consideration of development in areas without full municipal services is appropriate and site specific environmental and public health considerations are addressed.

2.0 POLICY EXPLANATION AND IMPLEMENTATION

2.1 Policy Explanation

2.1.1 Planning for Servicing and Infrastructure

The first part of policy B7 says that:

> "Servicing and *infrastructure* considerations will form an integral part of land use planning."

Servicing and infrastructure are fundamental building blocks for development and have the potential to greatly impact the natural environment. "Infrastructure" refers to the physical structures that form the foundation for development including sewage and water works, waste management systems, electric power, communications, transit and transportation corridors and facilities, and oil and gas pipelines and associated facilities. "Servicing" describes the act or result of employing sewage and water facilities to meet the physical needs of development and the community.

It is important to anticipate servicing needs and potential environmental impacts when municipalities are making decisions about growth and how it should be accommodated. It is not only important for municipalities to consider the servicing needs within their own boundaries, but also to be aware and take into consideration the servicing needs of the Province as a whole. In reaching land use planning decisions municipalities should consider existing and planned provincially related infrastructure, such as hydroelectric, hydrocarbon, transit, transportation and communications corridors and facilities (see Policy Statements B5, B6, B16). For an explanation of the terms used in this guideline see Appendix D, *Glossary*.

2.1.2 Planning for Sewage and Water Services

Policy B7 goes on to say that:

> "Municipalities will plan servicing facilities which maintain or enhance the quality of the natural environment to accommodate expected growth."

An effective means of planning for sewage and water services used by many municipalities is the preparation of servicing strategies such as multi-year sewage and water servicing plans. The Ministry of the Environment and Energy recommends that municipalities with the responsibility for sewage and water servicing plan for such services by preparing multi-year sewage and water servicing plans as one component of planning for growth management and preparing official plan policy. It is recommended that servicing plans be done in support of revisions to, or in the creation of, an official plan or can be done in support of planning documents prepared for areas proposed for potential growth (eg.; secondary plan or subwatershed plan).

It is recommended that municipalities communicate with neighbouring municipalities, and their respective public utilities where applicable, to develop cooperative approaches to planning for and providing sewage and water services. In many circumstances the most appropriate planning scale for sewage and water servicing is the watershed and subwatershed. The better understood the interrelationship between sewage and water servicing and natural water features and functions, the greater the efficiency of servicing over the long-term and the more effectively can the natural environment be maintained. In the interest of more comprehensive decision-making, municipalities may wish to take the opportunity to plan for servicing as one component of a broader planning exercise on a watershed/subwatershed scale.

Matters for consideration in the preparation of multi-year sewage and water servicing plans in conjunction with official plan policy include:

- investigate measures to resolve existing sewage or water problems within the municipality such as abatement of combined sewer overflows or addressing limitations to sewage collection/pumping stations and water distribution systems; and

- investigate servicing efficiency measures, such as the adoption of water conservation, toward reducing the demand on water supplies and treatment plant capacity (see Policy Statements and implementation guidelines under Goal E); and

- address how the municipality intends to service anticipated growth and identify what the implications are for the sewage and water services and the need for new services; and

- account for the efficient use of available existing infrastructure by calculating and reporting on uncommitted reserve capacity for sewage and water treatment facilities and establish a monitoring program for future use of that capacity; and

establish a monitoring program for future use of that capacity; and

- identify the physical and environmental constraints to development related to servicing; and

- adopt a hierarchy of servicing preferences as a guide for managing growth and settlement consistent with Policy B7 of (see Section 2.1.3 of this guideline); and

- generally describe the type and level of water supply and sewage disposal services which would support municipal goals for environmental protection or enhancement, sustainability, urban intensification, and growth management in a manner which is efficient and cost effective; and

- draw conclusions regarding the principle of whether to permit development in areas outside existing full municipal services on the basis of:

  - an evaluation of servicing options which includes the potential for full municipal services and communal services; and

  - a determination of appropriate areas to target for growth on the basis of the servicing option available within the context of criteria outlined under Policy Statements B7 through B11; and

- investigate and classify areas outside fully municipal serviced areas which may be targeted for growth by generally evaluating the potential growth areas according to their suitability for servicing. These servicing/environmental investigations (along with other planning concerns) should be the basis for municipalities to direct appropriate forms of development to areas least likely to suffer adverse environmental impacts. To confirm that the principle of development is appropriate, the investigations should be an overview based on a evaluation using existing information on environmental constraints which include soils, groundwater and surface water conditions and use, agricultural uses, storm water drainage, existing land uses, and environmental and physiographic features; and

- address the issue of residuals management including hauled sewage (septage) utilization/disposal in the case of septic tank systems and sludge utilization/disposal in the case of digested sludge.

NOTE 1: If a multi-year sewage and water servicing plan is completed according to the five key features of environmental planning (see Note 2, Appendix C) and the requirements of the municipal class environmental assessment process, MOEE will recognize and give credit for work done within the plan as part of future class environmental assessments (see Section 2.3, *Municipal Engineers Association Class Environmental Assessment for Water and Wastewater Projects*, 1993, and Section 16.1, *Planning Act*, 1995).

2.1.3 Hierarchy of Servicing Preferences

Policy B7 concludes by identifying a hierarchy of servicing preferences:

> "In areas serviced by *full municipal sewage and water services, development,* will be permitted only if sufficient *reserve water and sewage plant capacity* is available to accommodate it.
>
> *Development,* should be serviced by *full municipal sewage and water services* wherever feasible. Where *full municipal sewage and water services* are not provided, and where site conditions permit, multi-lot/unit *development,* should be serviced by *public communal services* . Where the use of *public communal services* is not feasible, and where site conditions permit, *development,* may be serviced by *individual on-site systems. Development,* on *partial services* will be discouraged except in the situation where a *public communal system* is required to address remediation of failed *individual on-site systems.*"

Official plans, in concert with sewage and water servicing plans, should adopt a hierarchy of servicing preferences which incorporate the principles in Section 2 of this guideline and are consistent with Policy B7, B8, and B9 as follows:

- development on full municipal services be the preferred mode of servicing where there is sufficient uncommitted reserve capacity or where there is the capability for full municipal services to be expanded;
- in areas lacking full municipal services, communal sewage and water services be the preferred mode of servicing multi-unit/lot development; and
- in areas lacking full municipal or communal services where development can be justified consistent with the Comprehensive Set of Policy Statements, the use of individual on-site sewage and water services, may be considered subject to meeting environmental and public health requirements.

a) Full Municipal Services

- New development should be directed to settlement areas with existing full municipal services or to where there has been a commitment to new full municipal services consistent with the Comprehensive Set of Policy Statements. Municipalities should anticipate and plan for needed sewage and water treatment capacity to accommodate municipal growth and development objectives through the adoption of conservation measures to extend existing capacity and/or the expansion of capacity.
- Accordingly, an integral part of planning for services is determining the status of uncommitted

reserve capacity at water and sewage treatment facilities and monitoring this capacity on an on-going basis. Municipalities responsible for sewage and water servicing should assume responsibility for tracking, reporting and allocating uncommitted reserve capacity, in conjunction with water conservation measures to optimize the use of this capacity.

- Where a municipality has determined that it is appropriate, consistent with the Comprehensive Set of Policy Statements, to accept the principle of multi-lot/unit development adjacent to settlement area boundaries or portions of hamlets, villages, towns, and cities which have existing full municipal sewage and water services, then full municipal services is the preferred method of servicing such development.[1](see Note 2)

b) Communal Sewage and Water Services

- Where a municipality has determined that it is appropriate, consistent with the Comprehensive Set of Policy Statements, to accept the principle of planned development in areas without existing full municipal services, the preferred method of servicing multi-lot/unit development is public communal sewage and water servicing (see Note 2).

- In preparing servicing plans or reviewing planning documents proposing development on communal services, municipalities should:

  - consider the potential, appropriateness and, if deemed necessary, the means of accommodating phased, multiple, or clustered development on communal services; and

  - designate areas for development proposed to be served by communal services based on an evaluation of environmental constraints that confirms that the principle of development is appropriate; and

  - plan to accept responsibility for public communal services for development proposing multi-lot/unit residential development (See Appendix B, *Application of Municipal Responsibility for Communal Sewage and Water Services*).

c) Individual On-site Sewage and Water Services

- In preparing servicing plans or reviewing proposals for development on individual on-site services in areas without full municipal services, municipalities should ensure that:

  - planned development can be justified consistent with the Comprehensive Set of Policy

[1] Note: Development on partial services (eg.; the provision of municipal water services in the absence of municipal sewage services) will generally be discouraged. Local circumstances such as the existing means and quality of servicing and physical constraints to servicing will be considered in determining whether partial services may be appropriate.

Statements; and

- municipal official plans do not anticipate or identify the provision of municipal services; and

- areas for development proposed to be served by individual on-site sewage and water services are designated based on an evaluation of environmental constraints that confirms that the principle of development is appropriate.

NOTE 2: Limited infill development on individual water supply and individual on-site sewage services within a settlement area may be considered only where there is no suitable receiver for effluent discharge from a full municipal or communal sewage facility, there are no existing or potential water quality or quantity problems, and site conditions permit.

2.2 Implementation

Within the context of the principles outlined in this guideline, the planning authority should review planning documents circulated under the Planning Act as follows:

2.2.1 Official Plans

The planning approval authority should not recommend approval of new or revised official plans, without official plans identifying areas for growth through official plan policies and designations based on multi-year sewage and water servicing plans which have evaluated servicing options consistent with Sections 2.1.2 and 2.1.3.

2.2.2 Site-Specific Official Plan Amendment/Individual Application Review

For site-specific official plan amendments/individual applications that are submitted within the context of approved municipal planning documents which have incorporated planning for sewage and water services (consistent with Policy B7 and as described in Sections 2.1.2 & 2.1.3 of this guideline) the following should be met:

a) Full Municipal Services

- for site-specific official plan amendments, the municipality demonstrate (e.g.; the proposal is in keeping with a municipal servicing strategy) to the approval authority that there will be sufficient uncommitted reserve sewage and water capacity available to service the proposed development

(see Appendix A, *Calculating and Reporting on Uncommitted Reserve Capacity at Sewage and Water Treatment Plants, Sections 4.0 & 5.0*). For individual applications, the Province considers capacity to be committed when draft approval is granted to a development in a fully serviced municipality.[2] In circumstances where capacity is tied to the construction of new or expanded treatment facilities, the capacity will be considered available once:

- Environmental Assessment Act approval has been given[3]; and,

- the municipal council responsible for financial decisions regarding sewage and water services has passed a council resolution approving a specific budget item that dedicates capital for the completion of facilities (such that the facilities are completed prior to the commencement of construction of development).

If a municipality brings forward a specific proposal for alternative approaches for calculating and reporting uncommitted reserve capacity, the MOEE Regional Office will consider entering into alternative arrangements (eg.; a development control agreement) with the municipality based on the merit of the proposal. Alternative approaches may be in regard to, for example, how the MOEE calculation is applied, use of an alternative calculation, or how a municipality allocates capacity.

b) Communal Sewage and Water Services

- an agreement for municipal ownership/responsibility for public communal services has been entered into between the developer and municipality for development proposing multi-lot/unit residential development (See Appendix B, *Application of Municipal Responsibility for Communal Sewage and Water Services*); and

- a terrain analysis and hydrogeological report or an assimilation capacity study have been completed in accordance with the requirements of the Environmental Protection Act and Ontario Water Resources Act which demonstrate that the proposal will not have an adverse effect upon

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2 In accordance with section 51, Planning Act, 1995, the approval authority in giving approval to a draft plan of subdivision may provide that the approval lapse after a specified time period, and thus, the committed capacity be re-allocated. See also section 70.3, Planning Act, 1995, regarding municipal authority to pass by-laws to establish a system for allocating sewage and water services to land that is the subject of an application under section 51. It is appropriate that municipalities that wish to use this provision describe in official plan policy the process for lapsing and re-allocation.

3 Municipalities may wish to combine planning processes. Under Section 16(1) of the Planning Act municipalities may prepare an official plan or official plan amendment that may be considered under the Environmental Assessment Act with respect to any requirements under the Environmental Assessment Act, including the Municipal Engineers Association Class Environmental Assessment for Water and Wastewater Projects, 1993.

the environment or public health[4].

c) **Individual On-site Sewage and Water Services**

- a terrain analysis and hydrogeological report or an assimilation capacity study have been completed in accordance with the requirements of the Environmental Protection Act and Ontario Water Resources Act which demonstrate that the proposal will not have an adverse effect upon the environment or public health[5].

Many municipalities have been given responsibilities under contract with the Province under Part VIII, Environmental Protection Act, RSO 1990, with respect to septic tanks and certain other sewage systems, including communal sewage systems which discharge to the subsurface. These responsibilities include (1) arranging for adequate inspection to be made of all parcels of land with respect to which an application for consent, plan of subdivision, minor variance, or plan of condominium is made which are not or will not be served by adequate sanitary sewers and (2) commenting to the body or person to whom such application is made on the suitability of such lands for sewage disposal. These responsibilities are often exercised by the Board of Health.

2.2.3 Site-Specific Official Plan Amendment/Individual Application Review in the Absence of Planning for Sewage and Water Services in Approved Municipal Planning Documents

In the absence of municipal planning for sewage and water services (as described in this guideline), the planning authority should not recommend approval for site-specific official plan amendments/individual planning applications proposing multi-lot/unit development, unless it is demonstrated that servicing options have been investigated and reported by means of a Servicing Options Statement (see Appendix C, *Servicing Options Statement*). Servicing options include the potential for servicing development on full municipal services, communal sewage and water services, and individual on-site sewage and water services consistent with this policy.

For the purposes of this guideline multi-lot/unit development means more than five lots/units of residential, industrial, commercial or institutional development.

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[4] See: (1) Manual of Policy, Procedures and Guidelines for Private Sewage Disposal Systems, 1982
(2) An Introduction to Communal Sewage Systems, 1994
(3) MOEE Guideline B-7, Incorporation of The Reasonable Use Concept into MOEE Groundwater Management Activities

[5] See: (1) Appendix E: Technical Guidelines for Septic Systems: Water Quality Impact Risk Assessment, March 1995
(2) Appendix F: Technical Guidelines for Private Wells: Water Supply Assessment, March 1995
(3) Manual of Policy, Procedures and Guidelines for Private Sewage Disposal Systems, 1982
(4) Ontario Regulation 358 under Part VIII, Environmental Protection Act, RSO 1990
(5) Ontario Regulation 903, Ontario Water Resources Act, RSO 1990

"More than Five lots/units" has been chosen because it is consistent with how environmental legislation defines what constitutes communal services under Sections 52 & 53, Ontario Water Resources Act RSO 1990, or under Part VIII, Environmental Protection Act RSO 1990. It is recognized that individual applications for small multi-lot/unit development in isolation from any other existing or proposed development may not be feasible on communal services or that the density associated with a particular development on communal services may not be desired. In the absence of official plan policy based on planning for sewage and water services, a servicing options statement can address the fundamental planning and servicing options at hand and ensure that informed decisions are made for community development that are consistent with the Comprehensive Set of Policy Statements. The servicing options statement can demonstrate how a particular development proposal(s) (and associated servicing) can fit most effectively into the existing community planning/servicing scenario and into any potential growth scenarios for the community.

A *servicing options statement* is not necessary for:

- development proposing connection to existing full municipal services within a designated settlement area, when it can be demonstrated that there is sufficient reserve sewage and water capacity as described in Section 2.2.2 of this guideline, or

- development proposing a servicing option that conforms to the existing official plan, where the official plan was prepared and approved in consideration of the principles described in this guideline and is consistent with the Comprehensive Set of Policy Statements.

Where applicable, the requirements of the municipal class environmental assessment process must be met (see *Municipal Engineers Association Class Environmental Assessment for Water and Wastewater Projects*, 1993).

The attached Appendices A, B, C, and D form a part of this implementation guideline and should be read with the body of the implementation guideline.

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APPENDIX A

CALCULATING AND REPORTING UNCOMMITTED RESERVE CAPACITY AT SEWAGE AND WATER TREATMENT PLANTS

1.0 RATIONALE

It is the position of the Province that the number of lots in approved plans of subdivisions, developments committed by virtue of approved zoning, new official plans or site-specific official plan amendments, should not exceed the design capacity of the sewage and/or water system. In order to ensure that capacity is not exceeded it is necessary to determine what uncommitted reserve capacity is available. This appendix provides a means for determining uncommitted reserve capacity. As noted in Section 2.2.2 of the implementation guideline, if a municipality brings forward a specific proposal for alternative approaches for calculating and reporting uncommitted reserve capacity, the Ministry of Environment and Energy (MOEE) Regional Office will consider entering into alternative arrangements with the municipality.

Prior to calculating the uncommitted reserve capacity, it is important to recognize other factors which may limit new development, such as:

- limitations to the sewage collection/pumping stations (i.e.: basement floodings, overflow conditions, etc.);

- limitations to the water distribution system (ie: low pressure caused by small diameter mains), and other factors.

To this end, the "owner" is responsible for ensuring these factors, as well as any of the relevant plant performance characteristics listed in Section 3.2 below, are considered before calculating uncommitted reserve capacity for water and sewage works.[1]

Plant performance and hydraulic capacity should be closely related to municipal growth management objectives in order to produce environmentally sound decisions regarding servicing. Municipalities should recognize that plant expansion or upgrades typically require a minimum of 3 to 5 years to develop, and should therefore plan for their long term development needs accordingly.

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[1] The "owner" refers to the legal owner of the facility, or the person designated as owner in the Certificate of Approval for the works.

Municipalities should not recommend approval, and approval authorities should not consider approval, for development proposals if the uncommitted reserve capacity calculation has not been prepared and submitted according to the principles set out in this document. Furthermore, if other factors which limit plant performance are not identified and addressed the application must be considered incomplete. MOEE is not able to process incomplete applications.

2.0 ROLE OF THE MINISTRY OF ENVIRONMENT AND ENERGY

MOEE, as the regulatory agency, is responsible for facilitating and promoting the compliance with the *Environmental Protection Act*, the *Ontario Water Resources Act*, and regulations enacted under those statutes. This mandate is fulfilled in part, through the issuance of Certificates of Approval, and based upon Ministry policies and guidelines. To this end, favourable comments from the MOEE on development proposals as they concern water and sewage treatment facilities, are contingent upon sufficient uncommitted hydraulic capacity and plant performance that is environmentally acceptable.

3.0 CALCULATING UNCOMMITTED RESERVE CAPACITY FOR SEWAGE AND WATER TREATMENT FACILITIES

In determining the uncommitted reserve capacity of sewage and water treatment plants, the following factors need to be considered: hydraulic capacity and plant performance in relation to environmental protection as set out in Ministry statutes, regulations and policies, and; the Certificate of Approval. Each of these matters must be considered by both the Municipality and the M.O.E.E. in assessing whether development proposals should be entertained.

3.1 Hydraulic Capacity

The uncommitted reserve hydraulic capacity should be calculated using the following formula:

$$Cu = Cr - \left[\frac{L \times F \times P}{H} \right]$$

Cu = uncommitted hydraulic reserve capacity (m^3/d)
Cr = hydraulic reserve capacity (m^3/d)
L = number of unconnected approved lots
P = existing connected population
H = number of households or residential connections
F Defined under:
Sewage Treatment Plants
F = average day flow per capita (m^3/capita/d)

Water Treatment Plants
F = maximum daily flow per capita (m^3/capita/d)

Please refer to the definitions provided in Section 6.0 to assist you with this calculation.

Note 1:

- The Formula accounts for industrial, commercial, institutional and other flows by means of the per capita flow figure which includes flows from all types of land uses and other flow sources such as infiltration. In certain cases, such as where there is evidence of seasonal population fluctuations, rapid growth and/or the existence of large industries, or in cases where per capita water or sewage flows for proposed new developments will be substantially different from historical flows, etc., the Regional MOEE Director may consider it reasonable and appropriate to modify the manner in which the calculation is completed. Municipalities are advised to consult their Regional MOEE office in this regard.

- In order to provide additional protection against the design capacity of the systems being overcommitted, municipalities may choose to apply separate allocations for uses such as industrial plans of subdivisions, site-specific industrial uses characterized by high water consumption, existing vacant residential lots and similar examples that could significantly reduce the calculated reserve capacity by increasing the per capita flow figure.

Note 2:

In calculating the uncommitted hydraulic reserve capacity, municipalities should ensure that the variable "L" represents all unconnected servicing commitments including:

- vacant lots/units in registered plans of subdivision and condominium
- lots/units in draft approved plans of subdivision/condominium;
- the maximum development potential of lands (i.e. scale and density) as permitted under existing zoning;
- registered plans of condominium;
- vacant lots created by consent in serviced areas.

Note 3:

For Water Treatment Plants:

- Maximum day flows to be subtracted from uncommitted reserve capacity should be calculated on the basis of those increased max day flows at the treatment plant - as opposed to a max day flow calculated for the development. The latter would be an unrealistic representation of the impact of a small development at the treatment plant in a large community.

The following are examples of calculations for sewage and water treatment plants, using the above formula:

For Sewage Treatment Plant

Cr	=	12,000 m^3/day
L	=	3,000 lots
F	=	.45 m^3/day
P	=	25,000 people
H	=	8,000

$$Cu = Cr - \frac{L \times F \times P}{H}$$

$$Cu = 12{,}000 - \frac{(3000 \times .45 \times 25{,}000)}{8{,}000}$$

$$= 7{,}781.25 \text{ m}^3\text{/day}$$

For Water Treatment Plant

Cr	=	20,000 m^3/day
L	=	3,000 lots
F	=	0.9 m^3/day
P	=	25,000 people
H	=	8,000

$$C_u = C_r - \frac{[L \times F \times P]}{H}$$

$$C_u = 20{,}000 - \frac{[3000 \times .9 \times 25000]}{8{,}000}$$

$$= 11{,}562.5 \text{ m}^3\text{/d}$$

3.2 Plant Performance Characteristics Which May Affect the Use of the Above Formula

For Sewage Treatment Plants

The following performance characteristics may be used as a basis for imposing limited or long term development constraints:

- the treatment facility is in poor condition, performing erratically or not in accordance with its design;

- the effluent quality parameters exceed or are near the limits specified in the plant's Certificate of Approval;

- the sewage strength (i.e. organic loading) varies significantly due to industrial discharges into municipal sewers.

For Water Treatment Plants

The following performance characteristics may be used as a basis for imposing limited or long term development constraints:

- the existing treatment facility is in poor condition and not capable in meeting the maximum day demands, limiting pressures, etc.

- existing water quality does not meet health related parameters of the Ontario Drinking Water Objectives as stipulated in the plant's Certificate of Approval;

3.3 Compliance with Certificate of Approval

Municipalities are responsible for ensuring that they are in compliance with Environmental Laws and the Certificates of Approval issued for their plants. Certificates of Approval typically identify effluent limits which must be met. Non-compliance for effluent quality must limit development in the same way as insufficient hydraulic capacity.

Typical examples of limiting factors established in Certificates of Approval for sewage works which must be complied with are: biochemical oxygen demand (BOD), suspended solids and phosphorus.

In many cases the Certificates of Approval also specify additional parameters which require monitoring (e.g., ammonia) depending on plant process. As a result, it is of critical importance that municipalities be aware of the specific requirements of their certificates. If the Certificate of Approval specifies a sampling protocol, it must be followed. If not, please refer to the MOEE policy entitled "Policy to Govern Sampling and Analysis Requirements for Municipal and Private Sewage Treatment Works (Liquid Waste Streams Only)" (MOEE Policy 08-06).

3.4 Policies of the Ministry of Environment and Energy

In addition to the requirements of the Certificate of Approval, there are a number of MOEE policies that govern the operation of treatment facilities (e.g. Ontario Drinking Water Objectives, Treatment Requirements for Municipal and Communal Water Works Using Ground Water Sources). This Ministry recommends that these policies be followed. Failure to comply with these policies may result in development restrictions imposed by this Ministry. Please refer to Appendix 1 for a listing of the policies. For copies of these policies please contact the nearest MOEE Regional or District Office.

4.0 ANNUAL REPORT

Municipalities should produce an annual report within 90 days of the end of each calender year, based on the calculation methods set out in this guideline. The annual report should address both hydraulic capacity and performance factors, and be retained by the municipality for a period of three (3) years. Under environmental legislation, these reports must be made available to Ministry personnel upon request.

The annual report must be authorized by an appropriate municipal official.[2] The date of the first annual report should be determined in consultation with the MOEE.

Note: Review and acceptance of an annual report by the MOEE should not be construed as confirmation of compliance with the requirements of the Certificate of Approval.

5.0 IMPLEMENTATION

Each development application circulated to the planning authority should be accompanied by written certification, prepared by the appropriate municipal official, which indicates that uncommitted capacity is available and has been allocated to the development.

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[2] "Appropriate municipal official" should be someone with credentials qualifying him/her to certify the capacity calculation as being a true and accurate reflection of the status of the sewage and water works. In an organized municipality, this would most likely refer to either the CEO or the Clerk.

6.0 EXPLANATION OF TERMS USED IN CALCULATIONS OF HYDRAULIC CAPACITY

Sewage Treatment Plants:

Design Capacity:

The design capacity may be defined in the Design Report or in the Certificate of Approval. The components of the wastewater flow may include:

- domestic wastewater;
- industrial wastewater;
- inflow/infiltration;
- storm water.

Average Daily Per Capita Flow:

The average daily per capita flow means the total sewage flow to the sewage works over twelve (12) consecutive calendar months, or during the period of operation upon which the report is based, divided by the number of days during the same period of time. Yearly average day flows are acceptable if the effluent compliance criteria for the defined parameters is based on average yearly concentration and loading limits.

Note: The use of 3 vs 5 year records in establishing representative average daily flows will be determined by the MOEE Regional Director.

Hydraulic Reserve Capacity:

The hydraulic reserve capacity is defined as the design capacity minus the actual existing recorded average day flow.

Uncommitted Hydraulic Reserve Capacity:

The uncommitted hydraulic reserve capacity is obtained by subtracting the previously committed flows of registered and draft approved residential, commercial and industrial lots, from the existing hydraulic reserve capacity.

Commercial/Industrial Lots:

Sewage flows for commercial/industrial lots must be determined by the municipality. Municipalities should do this by estimating the water consumption / sewage figures for similarly sized, similar type developments and factor this information into the calculation of the uncommitted reserve capacity. Moreover, it should be understood that in some cases organic loading, and not hydraulic loading, may be the limiting factor.

In exceptional circumstances it is not possible to estimate water consumption / sewage figures, municipalities may estimate the flow with the prior approval of the Ministry. If the Ministry agrees that this is acceptable in the specific situation, the following approach may be used:

> Industrial/institutional/commercial flows can be equated to an equivalent residential flow. A production/consumption rate of 100 gallons or 450 litres per capita per day of sewage flow or water demand should be used for designing sewage plants. This number will vary according to municipality. Once a specific industry is identified, the municipality will have a better indication of the amount of water the industry requires or the amount of sewage flows produced. The municipality will be able to determine whether its present sewage works can accommodate the industry.

Draft Approval:

Draft approved lots/units are those lots granted approval subject to certain conditions. These conditions must be fulfilled before the lots can receive final approval.

Draft approval is a commitment on behalf of the province and the municipality, and is interpreted by the proponent and the public as a reasonable assurance that development can proceed. Within a serviced municipality, the Province considers capacity to be committed to a development when draft approval is granted.

Water Treatment Plants

Design Capacity:

Design capacity of water treatment plants is defined as quantity of water which can be delivered to the distribution system when operating the plant under design conditions and is sufficient to meet the maximum day demand. (Greater capacities may be required depending on in-system fire flow requirements and storage capacity). The design capacity of water treatment plants can be obtained from the Certificate of Approval, Water Taking Permit, the design documents or design/operating manuals.

Hydraulic Reserve Capacity:

The hydraulic reserve capacity is defined as the design capacity minus the actual existing recorded maximum day flow. In some instances, the capacity of ground water supply wells or the perennial yield of the aquifer must be

determined in order to calculate the hydraulic reserve capacity for municipalities provided by such ground water supply systems.

Uncommitted Hydraulic Reserve Capacity:

The uncommitted hydraulic reserve capacity is obtained by subtracting the equivalent flow commitments to registered and draft approved residential, commercial and industrial lots from the existing hydraulic reserve capacity.

Commercial/Industrial Lots:

Water consumption for commercial/industrial lots must be determined by the municipality. Water demands for commercial/industrial establishments vary greatly with the type of water-using facilities present in the development, the number of people using it etc. Industrial water demands will vary greatly with the type of industry i.e. wet or dry operations.

In exceptional circumstances, municipalities may estimate the flow with the prior approval of the Ministry.

Draft Approval:

Draft approved lots/units are those lots granted approval subject to certain conditions. These conditions must be fulfilled before the lots can receive final approval.

Draft approval is a commitment on behalf of the province and the municipality, and is interpreted by the proponent and the public as a reasonable assurance that development can proceed. Within a serviced municipality, the Province considers capacity to be committed to a development when draft approval is granted.

Maximum Day Per Capita Flow:

The maximum day **per capita flow is based on the existing maximum day flow divided by the serviced population.** Lower maximum day flow figures may be accepted if the data indicates the highest flow(s) to the system occurred on an isolated basis, or where the municipality has successfully attempted to reduce leakage from the system and has also installed flow reducing devices.

As an alternative, the maximum day flow per capita may be derived by multiplying the average daily per capita flow with the maximum day factor.

The maximum day factor is available in the design report or determined by using the design manual.

Note: The use of 3 vs 5 year records in establishing representative maximum day flow will be determined by the MOEE Regional Director.

Addendum

LISTING OF MINISTRY OF THE ENVIRONMENT AND ENERGY POLICIES GOVERNING THE OPERATION OF TREATMENT FACILITIES

Guideline B-1:
Water Management - Goals, Policies, Objectives and Implementation Procedures of the Ministry of the Environment

Guideline B-13:
Treatment Requirements for Municipal and Communal Water Works Using Surface Water Sources

Guideline B-14:
Treatment Requirements for Municipal and Communal Water Works Using Ground Water Sources

Guideline B-15:
Use of Pesticides In and Around Water Works

Guideline F-5:
Levels of Treatment for Municipal and Private Sewage Treatment Works Discharging to Surface Waters

Guideline F-7:
Minimum Accepted Level of Servicing for Municipally and Privately Owned Communal Systems

Guideline F-8-1:
Policy to Govern the Provision and Operation of Phosphorus Removal Facilities at Municipal, Institutional and Private Sewage Treatment Works

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APPENDIX B

APPLICATION OF MUNICIPAL RESPONSIBILITY FOR COMMUNAL SEWAGE AND WATER SERVICES

1.0 RATIONALE FOR MUNICIPAL RESPONSIBILITY OF COMMUNAL SERVICES

The Province, particularly the Ministry of Environment and Energy (MOEE), has had considerable experience in the design, construction, operation and maintenance of communal sewage and water services. In this capacity, MOEE has usually become involved in providing communal services as a result of environmental and public health concerns in small communities where multiple private individual on-site services have malfunctioned. The Ministry also has many years of experience in the approval of private communal services. Through the Ministry's approvals process the technology and capability of communal services to perform has been and will continue to be examined by MOEE. However, proper design and construction alone cannot guarantee the integrity of private communal services. The technology can only perform to its capability if the facility is operated and maintained properly.

It has been the experience of the Ministry and other jurisdictions that private communal services, in the absence of a responsible public authority to ensure proper operation and maintenance, have a greater likelihood to malfunction as a result of poor management practices and that private operators are less likely to have sufficient funds to remediate problems. By having a responsible public authority provide regular operational monitoring and maintenance of communal services and identify maintenance needs before malfunctions can take place, a high level of protection of the environment and public health can be assured.

Proper management through responsible operation and maintenance is one of the key advantages of communal sewage and water services over multiple individual on-site septic systems. This advantage is in large part a result of the flexibility available in the design and management of communal services to meet the collective servicing demands of the users and to meet the site-specific assimilative needs to protect the environment. Flexibility offers the opportunity for communal services to be "tailored" for the specific type of development as well as for the site-specific environmental conditions (i.e., soils, groundwater, surface water, topography).

Given that proper operation and maintenance are the key factors in ensuring the long-term viability of communal services, it is recognized that a municipality, as a publicly accountable body, with permanency of place, is the appropriate authority to be responsible for ensuring the proper management of communal services.

The Ministry is particularly interested in ensuring the responsible management of communal services for residential development where residences may be permanent homes or primary residences. It has been the experience of MOEE that if private communal services fail (usually as a the result of not applying sufficient funds to maintenance), the operator and residents do not have usually have sufficient funds to fix the problem. The malfunctioning of sewage and water services is a public health and environmental threat that requires immediate action. With no funds and no immediate resolution of the forthcoming from the operator, the most appropriate response by the Ministry may be to issue an order that in effect shuts down sewage and water services until they can be repaired. In the situation of permanent residences this has the effect of making homes uninhabitable and forcing residents to vacate their homes. In the past taxpayers money has had to be used in these circumstances as a last resort to avoid people having to vacate their homes. This scenario can be prevented by proper management of communal services.

Municipalities should recognize that the responsibility to give planning approval to developments, imparts to municipalities an obligation to ensure that planning decisions represent viable development for the long-term such that residents can rely on access to sewage and water services that protect the environment and public health. Municipal responsibility through municipal ownership, operation and maintenance is the most effective means of establishing a preventative management framework within which communal services can be operated and maintained with the assurance of their long-term viability, thereby protecting the public health and environment.

2.0 LEGISLATIVE AUTHORITY

Environmental Protection Act
Ontario Water Resources Act
Planning Act

3.0 APPLICABLE PLANNING PROPOSALS

The document shall apply to:

- Expansions to existing multi-lot/unit residential development or new multi-lot/unit residential development to be served by communal water and sewage services and/or requiring approval under Sections 52 & 53, Ontario Water Resources Act, RSO 1990 and Part VIII, Environmental Protection Act, RSO 1990; or

- situations to be assessed on a case-by-case basis by the MOEE Director.

4.0 MUNICIPAL RESPONSIBILITY FOR COMMUNAL SERVICES

4.1 Organized Areas

In reviewing development applications located in organized areas that propose the uses described in Section 3.0 of this document, public communal sewage and water services will be required.

Where municipal ownership of communal services cannot be achieved, a *Responsibility Agreement* between the developer and the municipality will be requested by the planning authority. Such agreements will include provisions for municipal assumption of the communal services in the event of default and the provision of up-front secured funds (see Section 5.0).

The planning authority will not consider the use of *Responsibility Agreements* for applications proposing multi-lot/unit freehold residential development. For such development only municipal ownership, operation, and maintenance of communal services will be considered.

4.2 Areas without Municipal Organization

Developments proposing to use communal services should be encouraged to locate in municipalities where there are local public authorities to assume responsibility for these services and undertake remedial action in the case of default.

As a rule, the planning authority will comment negatively on proposals for new or expanded communal services in areas without municipal organization that are to be served by the uses described in Section 3.0 of this document. The rationale for this position is that in the absence of a municipal government organization the long-term viability of communal services, and hence the protection of the environment and public health, cannot be assured.

Communal services in areas without municipal organization will only be considered in the situation where they are required to address remediation of failed individual on-site services.

5.0 RESPONSIBILITY AGREEMENTS

- Municipal responsibility agreements are legal agreements between a municipality and developer which stipulate the conditions under which communal services will be constructed, operated and maintained, as well as, the action to be undertaken by the municipality in the event of default. Responsibility agreements form the basis for a preventative mechanism by establishing responsibilities for proper construction, operation and maintenance management practices and by providing up-front secured funds for any remedial measures that may be necessary in the event of default. When proper management practices are in place and enforced, malfunctions arising from poor operation and maintenance can be prevented and the long-term viability of the services, and protection of the environment and public health, can be assured.

- Responsibility agreements should contain financial assurance provisions which will ensure a security satisfactory to the municipality is available to the municipality for capital improvements should repair or replacement of services become necessary in the event of default and municipal assumption of the communal services.

- Responsibility agreements should contain reference to Section 79(c), Environmental Protection Act, RSO 1990, and Section 62, Ontario Water Resources Act, RSO 1990, and a statement verifying municipal acknowledgement of the possibility that, in the event of an environmental or public health problem related to communal sewage and water services, the Director may make an order requiring the municipality to act to correct the problem. The Ontario Water Resources Act, RSO 1990, S.62, states:

  (1) Where a Director reports in writing to the clerk of a municipality that he or she is of the opinion that it is necessary in the public interest that water works or sewage works or any part thereof be established, maintained, operated, improved, extended, enlarged, altered, repaired or replaced, it is not necessary to obtain the assent of the electors to any by-law for incurring a debt for any such purpose and the municipality shall forthwith do every act and thing in its power to implement the report of the Director. R.S.O. 1980, c. 361, s. 33 (1).

  (2) Where the municipality fails to do every act and thing in its power to implement a report made to it under subsection (1) forthwith after receipt of the report, and the time for taking an appeal has passed or there has been final disposition of an appeal by which the report is confirmed or altered, the Director, with the approval of the Board, may direct that whatever is

necessary to implement the report or the report as confirmed or altered be done at the expense of the municipality, and the Minister may recover the expense incurred in doing it, with costs, by action in a court of competent jurisdiction, as a debt due to the Crown by such municipality. R.S.O. 1980, c. 361, s. 33 (3).

- In addition, responsibility agreements should generally set out the following:
  a) operating and maintenance standards,
  b) a definition of default,
  c) an outline of remedial action in the event of default,
  d) financial assurance provisions,
  e) registration on title of the subject property,
  f) easements, where required;
  g) right of entry and inspection;
  h) that when required communal services (including any interests in the land) not already owned by the municipality will be transferred to the municipality at no cost to the municipality.

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APPENDIX C

SERVICING OPTIONS STATEMENT

Consistent with the Implementation Guideline, *Planning for Sewage and Water Services*, in the absence of municipal planning for services in an approved official plan (as outlined in Section 2.0, *Planning for Sewage and Water Services*), the planning authority should not recommend approval for site-specific official plan amendments/individual planning applications proposing multi-lot/unit development for other than development connecting to existing full municipal services in a settlement area, unless a *servicing options statement* has been completed. The *servicing options statement* must demonstrate that the potential for servicing the development on full municipal services and communal sewage and water services has been investigated. A *servicing options statement* should be prepared and/or endorsed by the municipality and submitted with the planning application by the developer in consultation with the municipality. The *servicing options statement* should address the following matters as appropriate:

- an evaluation of proximity of existing or committed full municipal services or communal services and the ultimate potential for future connection to full municipal services or communal services for the whole area proposed for development;

- where a development application is known or anticipated as being one of a number of proposals for the same development area, the evaluation of servicing options should not be isolated to the site-specific proposal, but should be completed within the context of the development potential for the whole area as determined through consultation with the municipality and based on proposed or existing municipal servicing plans and growth management objectives;

- an overview of the environmental suitability of the site for the proposed services based on information accessible at a municipal scale that can be applied to the proposed site proposal and generally addresses:

    - environmental constraints (e.g., environmental features, surface water, groundwater);

    - suitability of the terrain (e.g., soils, topography) of the site;

    - performance of services in similar developments in the surrounding area; and

    - the scale (total areal extent), density, and type of use proposed for the development;

- evaluation of the relative potential and merit of each of the servicing options to serve the proposed development; and

- documentation of the decision-making process and rationale that led to the determination of the servicing option proposed for the development.

NOTE 1: The complexity/simplicity of investigation associated with a *Servicing Options Statement* should be relative to the complexity/simplicity of the development proposal at hand as determined by the matters to be addressed in the *Servicing Options Statement.*

NOTE 2: Certain sewage and water projects are subject to the *Class Environmental Assessment for Municipal Water and Wastewater Projects, June 1993*, and any project has the potential to be the subject of a designation request or bump-up request under the environmental assessment process. It is, therefore, in the best interests of the proponent (developer and/or municipality) to evaluate servicing options by combining planning for services, through a servicing plan (or servicing options statement), and environmental assessment, through the Class EA, into one planning process. To meet the environmental assessment planning criteria under the Class EA, a proponent's evaluation of servicing options should reflect the five key principles of successful planning under the Environmental Assessment Act:

- consultation with affected parties early on (consistent with the requirements of the Class EA), such that the planning process is a co-operative venture;

- consideration of a reasonable range of alternatives;

- identification and consideration of the effects of each alternative on all aspects of the environment;

- systematic evaluation of alternatives in terms of their advantages and disadvantages, to determine their net environmental effects; and

- provision of clear and complete documentation of the planning process followed, to allow "traceability" of decision-making with respect to the project.

APPENDIX D

GLOSSARY

Default:

For the purposes of this document default describes **the situation whereby communal services are not being operated or maintained in accordance with prescribed standards and the operator is unable or unwilling to comply with prescribed standards which may include non-compliance with the Terms and Conditions of the Certificate of Approval for the system or works.**

Freehold Development:

For the purposes of this guideline freehold development means **development proposals subject to Section 50 of the Planning Act and not subject to the Condominium Act.**

Infill:

For the purposes of this guideline infill means **development on vacant lots or undeveloped lots within a built-up area.**

Multi-lot/unit Development:

For the purposes of this guideline multi-lot/unit development means **more than five lots/units of residential, industrial, commercial or institutional development.**

Multi-Year Sewage and Water Servicing Plan:

For the purposes of this guideline multi-year sewage and water servicing plan means **a plan prepared by a municipality responsible for sewage and water servicing that recommends a framework for the servicing of future works and developments which are to be distributed geographically throughout a study area and implemented over an extended period of time. The plan should contain long-range servicing strategies and long-term growth management goals which can form a basis for the preparation of official plan policy. The plan should address the implications for existing services to serve anticipated growth, efficiency of existing infrastructure including conservation measures, physical and environmental constraints to development related to servicing, and ensure that new services support the goals of environmental protection, sustainability, urban intensification and growth management in an efficient and cost effective manner.**

Sewage and Water Services:

Full Municipal Sewage and Water Services:
Means piped sewage and water services that are connected to a centralized water or wastewater treatment facility and provided by the municipality or another public body.

Communal Sewage and Water Services:
Generally mean sewage works and sewage systems and water works that can be described as small-scale satellite wastewater collection, treatment, and disposal facilities and water distribution, and possibly treatment, facilities using ground or possibly surface water as a source. Communal sewage services are separated from and unconnected to full municipal services which are connected to large centralized treatment plants that may serve entire municipalities. Communal sewage facilities can be comprised of gravity, pressure, or vacuum sewer collection systems, septic tank, secondary, tertiary, or stabilization pond treatment technologies, and discharge treated wastewater to either the surface of the ground, surface water, or subsurface environment.

For the purposes of this guideline and in keeping with existing legislation, "communal services" or "communal systems" mean **those sewage works, water works and sewage systems to be approved, or approved under Sections 52 & 53, Ontario Water Resources Act RSO 1990, or under Part VIII, Environmental Protection Act RSO 1990 for the common use of more than five units [in the total development area] of full-time or seasonal residential or industrial/commercial occupancy or other occupancy as determined by MOEE staff.**

Individual On-Site Sewage and Water Services/Systems:
Individual autonomous water supply and sewage disposal systems, that are owned, operated and managed by the owner of the property upon which the system is located and which do not serve more than five residential units/lots.

Public Communal Services:
Means sewage works and sewage systems, and water works that provide for the distribution, collection or treatment of sewage and water but which:

- are not connected to full municipal sewage and water services;
- are for the common use of more than five residential units/lots; and
- are owned, operated, and managed by either:
  - the municipality; or
  - another public body; or
  - where ownership by a municipality or another public body can not be achieved, by a condominium corporation or single owner through a responsibility agreement

with the municipality or public body, which requires municipal/public body assumption of the communal services in the event of default.

Uncommitted Reserve Capacity:
See: Appendix A, *Calculating and Reporting on Uncommitted Reserve Capacity at Sewage and Water Treatment Plants*

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